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# China Report

## ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT--55

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### CONTENTS

NATIONAL POLICY

Today's Energy Patterns To Continue Beyond Year 2000
(Liu Jingtong; CHINA DAILY, 24 Nov 86)..... 1

Energy Sector's Power for More Growth Questioned
(Lu Zhongyun, Chen Ming; LIAOWANG [OUTLOOK], No 26, 30 Jun 86)..... 3

Cooperative Initiative Between Ministries of Mineral Resources, Petroleum
(RENMIN RIBAO, 12 Jul 86)..... 10

Plans Refined To Build Huge Energy, Industrial Bases
(Du Yuejin; LIAOWANG OVERSEAS EDITION, No 50, 15 Dec 86).. 12

Big Foreign Loans To Cover Mine Expansion, Power Plants
(XINHUA, 30 Nov 86)..... 21

World Prices, Shipment Cutbacks Hurt Export Earnings
(Xie Songxin; CHINA DAILY, 29 Dec 86)..... 22

NEW TECHNOLOGY

Progress Noted in Preparation, Combustion Technology of Coal Slurry
(MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY], No 7, Jul 86)..... 24

POWER NETWORK

Power Output Outstrips Industrial Growth
(XINHUA, 10 Dec 86)..... 27

Machine-Building Industry Gives Strong Support to Power Sector
(ZHONGGUO JIXIE BAO, 16 Oct 86)..... 28

Shanxi Power Sector Undergoes Enormous Growth
(Zhao Pengling, Tai Jinzeng; SHANXI RIBAO, 3 Oct 86)..... 30

Briefs
Heilongjiang Transmission Line 31
Key Liaoning Substation 31
Longyangxia Forces Electricity Restrictions 31
Shaanxi 330KV Line Operational 31
Shandong Output Up 32

HYDROPOWER

Units Exhorted To Complete 7th FYP Mission
(SHUILI FADIAN [WATER POWER], No 8, 12 Aug 86)..... 33

Major Achievements in Key Hydropower Programs in 6th FYP
(Chen Zongliang; SHUILI FADIAN [WATER POWER], No 8,
12 Aug 86)..... 36

Work on Wan'an Project Goes Into High Gear
(Ouyang Ruhuan, et al.; JIANGXI RIBAO, 1 Oct 86)..... 41

State Council Forms Three Gorges Investigative Committee
(GUANGMING RIBAO, 31 Jul 86)..... 42

Factoring Comprehensive Benefits Into Assessing Hydropower Economics
(Yu Fuqiu; SHUILI FADIAN [WATER POWER], No 7, 12 Jul 86).. 44

Briefs
Taipingwan No 2 Unit Operational 49
Hunan Small-Scale Hydropower 49
Sino-Japanese Firm Wins Shuikou Contract 49
Shuikou Update 50

THERMAL POWER

Huainan To Become East's Largest Thermal Power Center
(JIEFANG RIBAO, 9 Dec 86)..... 51

Heilongjiang Experimental Gangue Plant Showing Promise
(XINHUA, 11 Nov 86)..... 52

Diandong Plant Now Fully Operational
(GUANGXI RIBAO, 25 Oct 86) ..... 53

Briefs

210MW Generators From USSR 54
Power Equipment From France 54
Liangzi He Plant Expansion 55
Xiaolongtan No 2 Unit Operational 55
Guixi Plant Adds Unit 55
Heshan Adds Final Unit 56

COAL

Despite Falling Prices, Greater Output Urged
(XINHUA, 13 Dec 86)..... 57

Coal Industry To Boost Production, Exports
(Guo Zhongshi; CHINA DAILY, 27 Nov 86)..... 58

Mines Gear Up To Meet Expected Export Demands
(XINHUA, 13 Dec 86)..... 60

Despite Claims of Success, Industry Only Meeting Minimal Requirements
(Gu Dalin; ZHONGGUO MEITAN BAO, 21 May 86)..... 61

Armand Hammer Visits Pingshuo, Said Encouraged by Progress
(Liu Xieyang; RENMIN RIBAO, 6 Dec 86)..... 65

Slurry Technology Said To Be at International Levels
(XINHUA, 4 Dec 86)..... 67

Coal Quality Inspection Center Established
(XINHUA, 23 Dec 86)..... 69

Liaoning's First Long-Flame Coal Gas Facility
(Jin Hongcai; LIAONING RIBAO, 2 Oct 86)..... 70

State To Set Up Consortium To Develop Shaanxi Field
(Shaanxi Provincial Service, 28 Nov 86)..... 72

Study, Utilization of Low-Ash Coal Resources in China
(Dai Hewu; MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY], No 9, Sep 86)..... 73

Briefs

Coal Exports Up 33 Percent 80
1986 Output: 870 Million Tons 80
New Mines Expected To Ease Strain 80
New Heilongjiang Reserves 81
New Shandong Colliery 81
Big Jiangxi Find 81
Fuel Oil Replacement Program 81

OIL AND GAS

Figures Show Oil, Gas Output Up in 1986
(XINHUA, 12 Dec 86)..... 82

Exploration, Production Registers Steady Progress
(XINHUA, 31 Dec 86)..... 83

New Management Brings Order to Petrochemical Industry
(Huang Fengchu; Xinhua Domestic Service, 19 Nov 86)..... 84

Shengli Overfulfills Drilling, Output Plans
(Shandong Provincial Service, 25 Nov 86)..... 86

Sichuan Natural Gas Development Moving Rapidly
(Li Daiyou, Shi Feng; SICHUAN RIBAO, 27 Sep 86)..... 87

Message to Foreign Firms: 'Share the Risk'
(XINHUA, 9 Dec 86)..... 89

Foreign Consortiums Study Development of South China Sea Finds
(Olivia Sin; SOUTH CHINA MORNING POST (BUSINESS POST),
13 Dec 86)..... 90

Briefs
New Shandong Pool 93
Shengli Directional Drilling 93

NUCLEAR POWER

Zhou Ping: Nuclear Power Can Solve Energy Shortage in Southeast
(Zhou Ping; RENMIN RIBAO, 4 Sep 86)..... 94

Issues in Construction of Nuclear Power Plants Discussed
(Jiang Xinxiong; GUANGMING RIBAO, 1 Aug 86)..... 97

Public Assured Chinese Plants Pose No Health Threat
(Geng Xiusheng, Wang Chaode; GUANGMING RIBAO, 1 Aug 86)... 100

5MW Reactor To Be Used for Urban Heating
(Da Chansong; CHINA DAILY, 16 Dec 86)..... 103

SUPPLEMENTAL SOURCES

Developing Geothermal Resources of the North
(GUANGMING RIBAO, 15 Aug 86)..... 105

CONSERVATION

Daylight Savings Time Experiment Saves Energy
(XINHUA, 29 Nov 86)..... 108

NATIONAL POLICY

TODAY'S ENERGY PATTERNS TO CONTINUE BEYOND YEAR 2000

HK240232 Beijing CHINA DAILY in English 24 Nov 86 p 4

[Article by Liu Jingtong, an official at the Planning Office of the National Energy Base, State Council]

[Text] The attainment of China's economic goals depends, to a large extent, on the development of energy resources. The solving of the country's energy problems in its modernization program is a matter of great concern.

Among the types of energy available to China, coal reserves are the most abundant, the most concentrated, and the most accessible. The strategy of developing coal as its main energy source is the only practical policy.

During the Sixth-Five Year Plan (1981-85), the nation took a series of measures to implement this policy, emphasizing both increases in the production of energy and effective savings in its consumption. As a result, energy production and supply have expanded greatly. Since the second half of last year, the balance of coal supply and demand has improved significantly. But this improvement is temporary, long-term equilibrium requires persistent efforts to overcome difficulties. It is expected that up to the end of this century and even into the early 21st century, the basic pattern of China's energy economy will remain unchanged, with coal accounting for about 70 percent of national energy consumption.

At the end of 1982, the Chinese Government designated a coal-rich area of North China as the national energy base, and formed the Planning Office of the National Energy Base under the State Council to be responsible for its planning and development. The base area includes parts of Shanxi, Henan, and Shaanxi provinces, western Inner Mongolia and Ningxia autonomous regions.

Proven coal reserves in this area account for 70 percent of the national total, and the volume transported to other regions made up 88 percent of all coal moved between various regions of the country in 1985. This figure is expected to increase to more than 90 percent in the 1990s. Accordingly, the way the energy base develops has a bearing on the solutions to the national energy problem, the country's overall economic development and in particular on the attainment of the economic objectives of the four modernizations by the end of the century.

The base's coal reserves are characterized by their size, variety, quality and ease of mining. The area is abundant in anthracite, coking coal and bituminous coal that can even be mined by local people on a small scale. The volume of investment required per ton of coal produced in the area is generally lower than that for coalfields in eastern China.

Shanxi Province is the mainstay of the energy base, supplying coal to more than 20 provinces and major cities. It will remain so up to the lowyplmp the century.

Further giant reserves have been found in the Shenmu and Dongxing coal field in northern Shaanxi and western Inner Mongolia. Its bituminous coal is of excellent quality and has a lower than average pollution rate. It has great potential for export and use in densely populated cities. The field has already attracted the attention of businesses from many nations.

By the year 2000, the coal output of the base will account for 50 percent of the national total, doubling that of 1985. The shipment of coal from the base will be three times that of 1985. Improved transport is crucial to move several hundred million tons from the energy base to needy areas. In recent years, improvements have been made to 10 rail lines, increasing the capacity to carry coal out of the base by 51.7 percent between 1980 and 1985. New lines are being built. The most notable is the Datong-Qinhuangdao line which, when completed, will be the first electrified heavy-duty line equipped to carry 100 million tons of coal per annum. In addition, several lines will be built to the seaports and to Northeast China. A network of railways, roads, waterways and pipelines will be built up mainly for coal transportation.

Owing to the limitations and costs of transporting coal, it is desirable to improve the geographical distribution of industries, especially iron and steel, aluminium, chemicals and building materials, which are high energy consumers. In general, they should be located inside or near the energy base.

The development of the energy requires a great deal of capital funding which could be provided by the government, by the units within the base area and by other sources through cooperation. Foreign investment and technological commercial cooperation should be encouraged.

/12624
CSO: 4010/15

## ENERGY SECTOR'S POWER FOR MORE GROWTH QUESTIONED

Beijing LIAOWANG [OUTLOOK] in Chinese No 26, 30 Jun 86 pp 22-24

[Article by Lu Zhongyun [4151 0112 0061] and Chen Ming [7115 2494]: "Energy Industry Advances With Its Heavy Burdens"]

[Text] Achievements in the energy resource industry in China through increased output in excess of quotas and a high rate of development have been gratifying. It has said "bon voyage" to the Sixth Five-Year Plan and entered the period of the Seventh Five-Year Plan.

The coming 5 years are the key period for laying a solid foundation and accumulating reserve strength for overall invigoration of China's national economy in the 1990's. During these 5 years, how will the energy resource industry, the foundation of the national economy, develop and will it be able to provide sufficient motive power for an even greater takeoff of China's economy?

For this reason, we visited three major sectors of China's energy resource industry: the Ministry of Water Resources and Electric Power, the Ministry of Coal Industry and the Ministry of Petroleum Industry.

### I. Electric Power: Joint Efforts by Thermal Power, Hydropower, and Nuclear Power To Reverse the Power Shortage Situation

Minister Qian Zhengying [6929 2973 5391] of the Ministry of Coal Industry made the following simplified general evaluation of the current situation in the electric power industry: the situation is very good and there are serious power shortages. She said that "our power shortages are shortages of power within a very good national economic situation. It is not that electric power has developed too slowly but rather than the rate of development in the national economy has been even higher." According to estimates, China had shortages of 12 million kWof power and 45 to 50 billion kWh of electricity during 1985. The scope of the power shortage has expanded from the coastal and central China regions into the interior and the northwest. A large number of factories have shut down because of power shortages and there have been no guarantees of the electricity needed for household use. This has not only created enormous economic losses but also has had direct effects on the lives of millions of people. Further development of agricultural production and continual improvements in people's

living standards have been accompanied by even greater demand for electricity, and the situation of inadequate supplies of electrical power may get worse. This makes solution of the power shortage problem a formidable task facing electric power departments during the Seventh Five-Year Plan.

If the economy is to be invigorated, then electric power must move forward first. This has become common knowledge. The CPC Central Committee stipulated clearly quite early that development of the energy resource industry must be focused on electric power. To reverse the power shortage situation and meet the needs of economic and social development, China's electric power industry will undergo even greater development during the Seventh Five-Year Plan. The scale of construction of power stations over the 5-year period will be 54.9 million kW, with 34.4 million kW of installed generators going into operation and producing power. An average of about 7 million kW will go into operation each year, which is more than double the amount that went into operation during the Sixth Five-Year Plan. By 1990, China will be producing 550 billion kWh of electricity, up by 142.7 billion kWh over 1985.

Based on China's resource situation, the principle of electric power construction during the Seventh Five-Year Plan will be: actively develop thermal power, strive to develop hydropower and construct nuclear power stations in a focused and gradual manner. Thermal power mainly will involve construction of a group of power plants in mining regions like Shanxi, Nei Monggol, Heilongjiang, Guizhou and other primary coal producing regions. A group of pit mouth power plants will be built in coastal regions and a group of regional power plants will be constructed in areas with convenient coal shipping and those near load centers. The focus for hydropower will be continued development of hydropower resources in the upper reaches of the Huang He, the trunk and tributaries in the middle and upper reaches of the Chang Jiang and the Hongshui He basin by building a group of large hydropower stations and a group of medium-sized hydropower stations in the northeast, east and other regions. Nuclear power will involve the construction of the first stage of the Qinshan nuclear power plant in Zhejiang and continued construction of the Guangdong nuclear power plant.

The key to whether China's power shortage situation will be moderated or intensified during the 1990's depends on how well the Seventh Five-Year Plan is implemented. It should be noted that there are a substantial number of favorable conditions and factors. First of all, the state gradually will increase the proportion of investments in electric power construction and will provide considerable policy assistance to the development of electric power. Second, electric power departments are focusing on reforms to promote construction and are adopting various active measures in an effort to complete and surpass the Seventh Five-Year Plan; they are strengthening capital raising for electric power construction, opening up capital sources and attracting everyone to build electric power; they are lowering the construction costs of projects, shortening construction periods and doing good work on "the second account" to accelerate the pace of construction in electric power; they are managing and using existing facilities and power grids well to assure that limited equipment can provide even greater results.

Even more important are the enormous achievements of the electric power industry during the Sixth Five-Year Plan that have laid a solid foundation for the Seventh Five-Year Plan. During the Sixth Five-Year Plan, electric power production completed power generation indices a year ahead of schedule, producing 46.5 billion kWh of electricity over the original plan. Actual power output in China during 1985 was 408.5 billion kWh and we jumped to fifth place worldwide in power generation. Capital construction in electric power also exceeded the Sixth Five-Year Plan, with an actual installed generating capacity of 20.42 million kW, an average growth rate of 5.5 percent. At the end of 1985, total installed generator capacity in China had was 86.29 million kW. China's electric power industry has entered a new stage of large generators, super high voltage and large power grids. During the Sixth Five-Year Plan, with the exception of the 29.6 million plus kW under construction during the Seventh Five-Year Plan, the state also was supplied with large amounts of design preparations and feasibility studies and preliminary designs were completed for a large number of large and medium s.zed projects. Moreover, a large amount of preliminary and preparatory work was done to put together a stronger ability to carry on with even greater developments in the electric power industry.

For these reasons, we have full reason to believe that implementation of the Seventh Five-Year Plan will be even better than predicted and tha: there are bright developmental prospects for the electric power industry.

II. Coal: Exploit Potential, Open Up Coal Routes, Climb to a Higher "Stage"

Coal historically has been China's primary energy resource. The most recent information indicates that coal still accounts for 70 percent of the structure of China's three main energy resources. Specialists in the area feel that no major changes will occur in this proportion before 2000 or 2050. For this reason, the development of the coal industry has a strong relationship with China's energy resource construction and will continue to have a major influence on the four modernizations drive.

The strategic goals of the coal industry during the Seventh Five-Year Plan based on the needs for development of the national economy are: in coal production, national raw coal output will grow by an average of 40 million tons a year, with output reaching 1 billion tons in 1990, up by 200 million tons over 1985. In capital construction, financial and material resources will be concentrated for new construction and expansion of a large number of mines. Some 31.5 billion yuan in investments will be completed, the scale of construction will reach 180 million tons and total output capacity that goes into operation will be 160 to 170 million tons. Moreover, there will be a focus on surveys and prospecting in key regions to provide industrial reserves of 20 to 25 million tons and newly proven reserves of 50 million tons.

The reliability of these forecasts for the future involves nothing more than an evaluation of the rationality of the present situation. China has extremely rich coal resources that provide an enormous foundation for

long-term development of the coal industry. Coal reserves account for more than 770 billion tons or about 90 percent of China's proven energy resources. More than one-half of China's 2,000-plus counties (and cities) have coal deposits. Several of China's large coal producing regions like Shanxi, Nei Monggol, Xinjiang, Guizhou and others are world famous for their reserves. Proven reserves in Shanxi alone exceed 200 billion tons, the highest in China. Many large coal fields have been discovered in recent years. It is apparent that coal has unlimited developmental prospects.

More than 30 years of construction have meant that the coal industry in China already exists on a substantial scale. There also were very large developments in the coal industry during the Sixth Five-Year Plan. Total coal output in China reached 715 million tons in 1983, and the 700 million ton index in the Sixth Five-Year Plan was completed 2 years ahead of schedule. China took only 34 years to reach the 700 million ton level, which took 108 years in the United States and 48 years in the Soviet Union. It is obvious that China's coal industry has developed at a very rapid pace. There was a major step forward in coal output in China during 1985 as we moved again up to the 800 million ton level, second in the world. This sort of successive and substantial increase in coal output indicates that China's coal industry has entered a stage of sustained and stable development. During the Sixth Five-Year Plan, China also constructed and put into operation a large number of large and medium sized coal mines and newly proven coal reserves amounted to 410 billion tons. There also have been major improvements in levels of mechanization, which reached 45 percent in unified distribution coal mines in 1985. Local coal mines also underwent major development during this period and production capacity grew by more than 34 million tons.

Of course, it also should be noted that certain difficulties and problems continue to exist within and outside of the coal industry that must be earnestly studied and solved, the main ones being that:

During the Seventh Five-Year Plan, the coal industry is beginning from a high starting point. It must increase output each year by an average of 40 million tons on the foundation of an annual output of 800 million tons, the difficulty of which is easily understood. As for the forces of production in coal mines, extraction at greater depths will make it ever more difficult to increase output by a substantial degree.

Communication and transportation shortages have created large overstocks of coal that have severely restricted the development of coal production. Shanxi Province alone has overstocks of 50 million tons, resulting in major losses.

Capital construction tasks during the Seventh Five-Year Plan are extremely arduous and we also must work to complete works under construction that arose from the Sixth Five-Year Plan with unsolved problems of inadequate capital.

To deal with these problems, the state and the Ministry of Coal Industry have taken action to adopt these policies:

1. Rational determination of the distributional principles and developmental orientations of the coal industry. Technical transformation in mines holds the primary position with arrangements first of all being made for mine transformation and expansion. We must complete and put into operation those projects under construction that are holdovers from the Sixth Five-Year Plan and permit them to play their roles. At the same time, there should be arrangements where appropriate for a group of medium and small mines that conserve investments and provide results quickly to provide coal in advance of schedule to guarantee completion of output plans for the Seventh Five-Year Plan. Active support should be provided to aid the development of local coal mines so that they play an even greater role during the Seventh Five-Year Plan.

2. Capital raising from many areas. One thing is to depend on state assistance and provide certain preferential policies. The second is for the Ministry of Coal Industry to use various channels to raise funds. The third is to persist in the use of foreign capital and utilize foreign investments during the Seventh Five-Year Plan for additional expansion of a group of projects during the Seventh Five-Year Plan.

3. Strive to improve communications and transportation conditions, open up new coal shipping routes, with railroads, highways and water transport advancing together to guarantee that the channels for shipping coal out remain open.

If these measures are effective and if we achieve full utilization of all types of conditions and overcome problems, then the goals of the Seventh Five-Year Plan can be attained.

III. Petroleum: Focus on Exploration, Guarantee Output, Reopen Macro Plans

Although China's petroleum industry began to develop rather late, it has developed quickly. In 1960, the Daqing oil field was completed and went into operation, which was indicative of the fact that China's petroleum industry had entered a new developmental stage and that China no longer had a shortage of petroleum. Petroleum and natural gas have been found in 22 provinces and autonomous region over the past 30-plus years and development has been begun at more than 180 oilfields. These include a group of large oil fields like Daqing, Shengli, Zhongyuan, North China and so on. Yearly crude oil output at the Daqing oil field has exceeded 50 million tons since 1976 and it has been predicted that this level can be held stable until after 1990. The Shengli oil field is China's second largest oil field and the "second Daqing" of the future. Its output now has reached 27 million tons and themomentum of development is quite vigorous.

The Sixth Five-Year Plan was one of China's best periods in terms of development of the petroleum industry. Yearly crude oil output has been maintained consistently above 100 million tons and a total of 548 million tons of crude oil was produced over the 5-year period. A new situation also was opened up in petroleum exploration that revealed the excellent prospects for petroleum development in China. More than 30 zones of rich oil and gas accumulation were discovered during the Sixth Five-Year Plan, with newly-proven geological petroleum reserves of 3.1 billion tons. Petroleum prospecting now has been carried out on more than 5 million square kilometers in China and new discoveries are being made continually. Moreover, new developments also have been made in natural gas exploration. A group of high output oil and gas fields were discovered during prospecting in eight regions like Zhongyuan [the central plains], Beijing-Tianjin-Tangshan-Liaoning, the Shaanxi-Gansu-Ningxia Basin, the Sichuan Basin and other areas. China has strengthened cooperation with foreign countries in recent years and gradually expanded marine exploration, with the discovery of 23 oil and gas flow structures that have created favorable conditions for further development of marine oil fields. All of these provide a solid foundation for achieving the goals of the Seventh Five-Year Plan.

To meet these major developments in China's oil and gas industry, the Ministry of Petroleum Industry has pointed out clear developmental principles for the petroleum industry during the Seventh Five-Year Plan; resolutely place prospecting work in the primary position and make all efforts to guarantee the completion of tasks for additional petroleum and natural gas; guarantee the completion of crude oil and natural gas production plans and strive to create the conditions for benign cycles in petroleum industry production; work actively to promote technical progress and technological transformation and work for speed, quality and results in science and technology.

Based on the demands put forth in the Seventh Five-Year Plan, crude oil output in China will reach 150 million tons in 1990, an increase of 25 million tons over 1985. Natural gas output will reach 15 billion cubic meters. In addition, the plan also calls for an additional crude oil extraction capacity of 60 million tons, an additional natural gas extraction capacity of 3 billion cubic meters, and new geological reserves of 7 billion tons of petroleum and more than 80 billion cubic meters of natural gas.

The tasks are extremely arduous ones. As development of the national economy and society proceed, state demand for petroleum will continue to increase. This places very great pressures on the petroleum industry. Moreover, there are many obstacles to development of the petroleum industry, such as further improvement of the proportional relationship between reserves and output. A great deal of work also must be done in the area of converting resources into reserves and reserves into output. Moreover, the lack of matchups between projects, weak administration and management, capital shortages and other contradictions also are quite prominent. All of these are factors restricting the development of the petroleum that

cannot be ignored. We must dare to shoulder heavy burdens and have the courage to meet the most formidable tasks. Those with a glorious tradition in petroleum construction are not defeated by difficulties and they now are bringing their drive into full play, welcoming the challenge and carrying out hard-fought battles for even greater development of China's petroleum industry.

The above is only a general outline of the current situation and prospects for China's energy resource industry. The developmental momentum in the energy resource industry itself has been gratifying but we cannot be overly pleased given current demand for energy resources in the national economy. For this reason, our evaluations of the energy resource situation should be cautious in our optimism. Ways of compensating energy resource shortages, alleviating the contradiction between supply and demand and achieving synchronous and coordinated development of the entire national economy and society are the main problems we now face and will have to deal with in the future. For this reason, cadres and employees on the energy resource battlefield have the clearest understanding and they are fully aware of the burden of their tasks and are willing to multiply their efforts ten or even one hundred-fold. We are looking forward to the time 5 years from now when the party and the people make their red marks in energy construction on the film of the contributions made in the Seventh Five-Year Plan.

12539/12624
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## COOPERATIVE INITIATIVE BETWEEN MINISTRIES OF MINERAL RESOURCES, PETROLEUM

Beijing RENMIN RIBAO in Chinese 12 Jul 86 p 3

[Article: "Ministers From Ministry of Geology and Mineral Resources and Ministry of Petroleum Industry Take Action To Coordinate Activities and To Strengthen and Improve Cooperation Between Ministries"]

[Text] The State Council Office recently issued a notice concerning the printing and publication of the main points of discussions between Zhu Xun and Wang Tao to all regions and departments. The notice pointed out that Minister Zhu Xun of the Ministry of Geology and Mineral Resources and Minister Wang Tao of the Ministry of Petroleum Industry have taken the initiative to hold direct discussions to strengthen cooperation between the two ministries in petroleum geology work through a broad exchange of opinions and actual solutions to problems in order to strengthen and improve relations and cooperation between their ministries and thereby created an excellent starting point. Leading comrades in the State Council have praised and encouraged the spirit of taking active measures to coordinate activities.

The notice expressed a hope that primary responsible comrades in all regions and departments would study this spirit and strengthen linkages in their work, and that they would begin with the overall situation concerning the main problems between regions and departments in actively meeting to achieve negotiated solutions and to prevent buck-passing, overcome bureaucratism and improve work efficiency, which plays a model role in correcting Party working styles, transforming organization working styles and promoting linkages.

Not long ago, Minister Zhu Xun of the Ministry of Geology and Mineral Resources and Minister Wang Tao of the Ministry of Petroleum Industry held a broad-ranging exchange of opinions concerning stronger cooperation between the two ministries in petroleum geology work, exploring more and better oil and gas resource reserves, providing services to a new take-off in the petroleum industry and other questions. They also straightened out the "points of discussion."

The two ministers felt that the key to achieving the Party's overall tasks and goals during this new historical period and the corresponding goal of increasing crude oil and natural gas output by 1990 and 2000 is whether or not prospecting will be able to provide sufficient oil and gas resource reserves

for development and utilization as soon as possible. An amount of oil and gas reserves exceeding that proven over the past 36 years must be proven within the next 15 years, so the tasks are quite difficult. Moreover, oil and gas prospecting is becoming more difficult. The situation and tasks demand that geology and mineral resource staffs cooperate as one with those involved in petroleum geology in future work.

The two ministers felt that the development of horizontal linkages between the ministries not only conforms to the spirit of reforms but also could make full use of the advantages of each as a foundation for making full use of advantages of integration. The forms taken by the linkages can vary considerably, including things like having excess forces in the Ministry of Geology and Mineral Resources undertake contractual responsibility for various types of project construction tasks in the Ministry of Petroleum Industry, having staffs from each of the ministries integrate their prospecting activities through unified designs, engaging in joint extraction in a small number of areas, mutual training of specialized personnel by the other side, exchange of technical experiences, providing technical assistance, and other areas.

To avoid unnecessary repetition in work and make full use of the comprehensive economic results of investments in oil and gas prospecting, the two ministers agreed that their ministries will unify planning and make a rational distribution of labor and coordinate their activities in oil and gas geology work and that they will provide each other with information concerning their own work areas. To encourage the initiative of geology and mineral resource departments to explore for geological and mineral resources and increase capital for prospecting, the two ministries have been involved in formulating the "Methods for Compensated Transfer of Oil and Gas Reserves" to enable geological and mineral resource staffs to obtain greater benefits from the compensated transfer of reserves.

To correct party working styles, prevent buck-passing, strengthen cooperation, and improve efficiency, the two ministers held discussions and called for stronger professional relations at all levels in the future. Leaders in each of the ministries should set dates for meetings and use various patterns for timely exchange of opinions on major problems encountered, solve problems that have occurred or that may occur during movement forward, promote close cooperation in oil and gas geology work between the two ministries, and make even greater joint contributions to a takeoff in the petroleum industry.

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NATIONAL POLICY

## PLANS REFINED TO BUILD HUGE ENERGY, INDUSTRIAL BASES

HK251354 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 50, 15 Dec 86 pp 10-12

[Article by Du Yuejin [2629 6460 6651]: "Important Plans Based on the Strategy for Developing China's Energy Sources"]

[Tex oing all out to build a modern country, China very often finds itself gasping, like a giant that walks haltingly. The lack of "fuels" is a drag on the country. According to statistics, China is short 20 million tons of coal, 10 million tons of petroleum, and 50 billion kilowatt-hours (kWh) of electricity a year and about one-fourth of its industrial production capacity was idled because of power shortages, losing nearly 100 billion yuan in output value.

Industry experts say: To put a complete end to energy shortages, apart from taking various appropriate energy conservation measures and vigorously raising the utilization rate of energy resources, we must build one or two large-sized energy bases like the Ruhr mining region built by the FRG in the past. In light of the actual conditions in China, these experts have put forth two tentative plans: One is to build an energy base centered around the Three Gorges hydropower project whose installed capacity will total 100 million kW, and the other is to build a coal-oriented energy base covering five provinces and regions in the middle reaches of the Huang He. Due to various reasons, the Three Gorges project cannot be built for a considerable period of time. Therefore, people have pinned their hopes for solving the energy problem on the coal industry.

This coal-oriented energy base includes the whole Province of Shanxi, three cities and five leagues in western Nei Monggol, the region west of the Beijing-Guangzhou railraod in Henan Province, the region north of Qin Ling in Shaanxi Province, and all of Ningxia. It has a total area of 1.17 million square kilometers and a population of nearly 100 million people.

"A Great Move" is Imperative

In the last 30 years or so since the founding of the PRC, energy construction has made rapid progress. Total energy output in 1985 amounted to more than 855 million tons of standard coal, ranking third in the world following the

United States and the Soviet Union. During the 1949-1985 period, raw coal output jumped from 32 million tons to 872 million tons, crude oil output from 120,000 tons to 124.9 million tons, and electricity output from 4.3 billion kWh to 410.7 billion kWh.

However, these figures are very marginal when the amount of such goods per person is considered. China's average per capita consumption of goods is no more than half of the world's average value. With the development of production and construction and the improvement of the people's living standard, China's energy supply has been strained for years. In 1982, the 12th CPC National Congress set the strategic objectives of quadrupling the nation's gross output value of industrial and agricultural production and achieving a well-to-do standard of living by the turn of this century. One important precondition for realizing this ideal is that China's energy output by the year 2000 will reach more than 1.4 billion tons of standard coal. In other words, 15 years from now, China's total net energy output must increase by over 500 million tons of standard coal a year. It can thus be seen that in terms of whether "recent worries" or "long-term considerations," it is imperative for China to make a great move in energy construction.

Of the Three Major "Conventional Energy Resources," Priority Should Be Given to Coal

Where should the main direction of China's energy development lie?

Coal, petroleum, and water power are China's three major "conventional energy resources." Although China has rather large prospective petroleum reserves, its existing reserves have greatly decreased because of intensified exploitation and relaxed prospecting in the last dozen years. This being the case, to increase petroleum output by a wide margin in a short time, we are faced with difficulties. If so, or even if, there is a fairly big increase in petroleum output, to accumulate funds the state also will export a considerable portion of its petroleum to earn foreign exchange to intensively process industrial chemicals. Therefore, for a considerably long period of time to come, petroleum will not occupy a leading position in China's energy consumption.

China ranks first in the world in water resources. According to the statistics of a general survey, the country has a theoretical hydropower reserve of 676 million kilowatts, an exploitable hydropower capacity of 378 million kilowatts, and an annual electricity output of 192 billion kWh. However, China's rivers have a special feature, that is, the amount of water flow varies widely from year to year and from season to season. Take the endlessly debated key place of the Three Gorges project as an example. If a gigantic hydropower station with an installed capacity of 13 million kilowatts is constructed there, its generating units can produce a total of only 3 million kilowatts of electricity in the dry season. This means we still need to build additional thermal power plants with installed capacities of more than 1 million kilowatts to regulate the project. Again, most of China's water resources are distributed in the border areas in southwest China. Therefore, it is inconvenient to develop and utilize them. In addition,

although the cost of hydroelectric power is relatively low, the contradiction between its rather long construction period and the current situation in which energy is badly needed and that between a too big, one-time investment in hydroelectric power development and the state's current limited funds is glaring. Therefore, it needs some time to accumulate funds and to make technological preparations for carrying out construction on a large scale.

Today, when world energy consumption has moved to a pattern in which petroleum plays a dominant role, China has become one of the few countries that use coal as the main energy source. For quite some time, coal has constituted 70 percent or more of China's total energy production and consumption. True, the formation of this special pattern cannot be separated from previous technological policies, but in the final analysis it is decided by the nature of China's coal industry. According to the estimates of the 10th World Energy Conference, China's total coal reserves are 5.07 trillion tons, ranking second in the world after the Soviet Union, and its predicted reserves are 1.4 trillion tons, ranking third in the world. Of course, these two reserve figures cannot be used as a real basis for drawing up our plans for the time being. At present, the verified coal reserves that can be used as a real basis for drawing up plans is 700 billion tons or so. In other words, by the end of this century, if coal is mined at a rate of 1.4 billion tons a year, as predicted by experts, China's coal reserves can be continuously extracted for 200 or 300 years. Moreover, most coal in China is of high quality and conditions for coal extraction are relatively good. Therefore, comparatively speaking, coal mining needs less investment. This determines that in the foreseeable future, the main force of China's energy industry can be nothing but coal. The situation in which coal constitutes 70 percent or more of the nation's total energy production and consumption will last for quite some time.

In Terms of Distribution Priorities, China Enjoys Exceptional Advantages

The distribution of coal resources in China is quite uneven. Taking the Beijing-Guangzhou railroad as a line dividing China into eastern and western regions, the verified plus predicted coal reserves in the eastern region constitute 15 percent of the national total while those of the western region constitute 85 percent. Taking Qin Ling-Da Bie Shan as a line dividing the country into northern and southern regions, the verified plus predicted coal reserves of the northern region constitute 94 percent of the nation's total and those of the southern region constitute 6 percent. The verified plus predicted coal reserves of the region west to the Beijing-Guangzhou railroad and north to the Qin Ling-Da Bie Shan, including Shanxi, Henan, and Shaanxi provinces and Nei Monggol and Ningxia autonomous regions make up 43 percent of the nation's total while those of nine provinces and cities south of the Chang Jiang constitute 0.6 percent. Coal is concentrated in the northern, western, and northwestern regions of the country. This is the major distribution pattern of coal resources in China.

When people look more closely at the five provinces and regions in the middle reaches of the Huang He, they will discover:

--This region's existing verified coal reserves amount to more than 500 billion tons or 70 percent of the country's total, including 200 billion tons or more in Shanxi, 150 billion tons or more in western Nei Monggol, 170 billion tons in western Henan, nearly 100 billion tons in northern Shaanxi, and 30 billion tons or more in Ningxia. The large coal fields with existing reserves of more than 100 billion tons or more include the Qinshui field in Shaanxi, and Ningxia. The reserves of these two fields are much greater than those of the U.S. Appalachians, the Soviet Union's Kuzbas, and the FRG's world-famous Ruhr coal fields.

--Regarding coal development conditions, the geological structure and hydrological conditions of coal fields in this region are simple and most coal resources are shallowly buried, mostly 100 or 200 meters below the earth's surface. Some are suitable for open-cut mining. Being thick, coal seams slope steadily and gently. This being the case, the construction period of pits can be rather short and the investment required to produce a ton of coal less.

--In terms of coal varieties and quality, this region has every kind of coal that one expects to find, including top-quality power coal, top-quality anthracite, top-quality rich coal that can be used to produce coke, primary coking coal, and lean coal. Moreover, most of them are low in line and sulphur content but their calorific capacity is high.

Since the region is strong in coal resources, it has become a powerful competitor for building a large-sized energy base.

"Three Characters" Embody Another Concept

The energy bases under construction are all called "energy-heavy chemical industrial bases." The three characters of "heavy chemical industry" are an embodiment of another concept in China's economic construction. In other words, while building energy bases with the focus on the coal industry, the national distribution of high-energy-consuming industries should be readjusted to obtain the target of killing two birds with one stone, that is, both easing pressure on the transportation sector and promoting local economic and social progress.

"Heavy chemical industry" refers to iron and steel and nonferrous industries and the basic chemical industries that use coal as the raw material. A comprehensive survey of the general pattern of productive forces on the Chinese mainland, shows that the western and southwestern regions are rich in coal but are industrially underdeveloped and economically backward, while the gross industrial output value of the eastern and coastal regions, which are relatively lacking in coal but are big energy consumers, constitutes more than 70 percent of the nation's total and their economies are comparatively developed. The consequences brought by this irrational pattern are

obvious. The western region of the mainland, where the country's energy bases are located, has not only rich coal resources but also bright prospects for developing coal-based chemical industries. Moreover, it is considerably abundant in other mineral resources. The existing reserves of its bauxite account for 60 percent of the country's total; those of rare earths, 97 percent; and those of molybdenum and natural soda, 50 percent. The region has considerable liver pyrite, mirabilite, and oil shale reserves. Coal-gas resources in Eerdousi are abundant and promising for development.

Evidently, the region is not only qualified to become an energy production and supply base but it is also necessary and entirely possible to become a base for transforming energy on the spot and developing the raw and semi-finished materials industry.

Bo Yibo Initiated the Building of an Energy Base and Zhao Ziyang Gave the Final Endorsement

For a considerably long period of time, "putting an end to the state of affairs in which coal has to be sent from the north to the south" has been China's basic principle for developing its coal industry and for this purpose, large amounts of human, financial, and material resources have been poured into the region south of the Chang Jiang where coal resources are limited. As a result, the large amounts of resources used in the south failed to produce a sufficient amount of coal while the places such as Shanxi "had difficulties shipping out their coal" due to a drastic reduction in investment and relaxed construction of railroads. This considerably intensified the already strained coal supply all over the country.

In 1979, Bo Yibo, then vice minister of the State Council, went to Shanxi to inspect coal production there. He proposed the building of Shanxi into a strong energy base as rapidly as possible. This is of great significance for both Shanxi and the whole nation in achieving the four modernizations. Later, the State Planning Commission, the State Construction Commission, and the ministries of Coal Industry, Railways, and Water Resources and Electric Power formed a joint fact-finding group to conduct investigations in Shanxi and Nei Monggol on such problems as how to vigorously develop coal resources. The group's findings suggest that vigorously developing the coal resources of Shanxi and Nei Monggol and building them into strong energy bases to support the other parts of the country be taken as a major plan for realizing the four modernizations.

In May 1981, Yu Qiuli, then minister in charge of the State Energy Commission, went to Shanxi and Henan to conduct investigation and study on how to speed up the development of the coal industry. In his report to Zhao Ziyang, Wan Li, and Yao Yilin, he made several policy proposals for developing coal production in Shanxi. He also made a speech at a State Council meeting on the question of building a coal base in western Henan. In accordance with Zhao Ziyang's instruction, Ma Hong, chairman of the Technological and Economic Research Center of the State Council, organized experts in various fields to conduct deliberations on the matter. Experts agreed that in exploiting Shanxi's coal, we should have the overall situation in mind and carry out the work in a comprehensive way.

Before and after this, a dozen experts or so from the Chinese Academy of Social Sciences lived in Taiyuan for a long time to provide help and guidance in specific matters. Giving play to its strong points in having various branches of learning, the Chinese Academy of Sciences organized 32 research institutes to conduct investigations and study lasting for six months. They put forth 55 projects for tackling key technological problems, 29 projects to be popularized in the near future, and 10 long-term scientific research projects. Qinghua University, the Jiaotong University of Xi'an, and other units programed tens of economic models using modern scientific methods and computers to conduct a quantitative analysis. Experts from such units as the Beijing Industrial College, the Beijing Normal University, and the Chinese Academy of Environmental Science did much work to prevent environmental pollution in energy bases. In 1 year's time or longer, more than 1,400 experts, scholars, and workers were involved in the investigation and study work of energy bases. They made numerous proposals for the construction of energy bases from different aspects.

In July 1982, Premier Zhao Ziyang personally went and inspected Shanxi. After listening to the opinions from all sides concerned, he said: Exploiting Shanxi coal is indeed an important strategic plan for solving China's energy problem. It is necessary to relate coal development in Shanxi to the development of the coal fields in western Nei Monggol, western Henan, northern Shaanxi, and Ningxia. Geographically,they are only 500 or 600 km from coastal ports such as Tianjin and Shijiusuo while the shipment of Soviet coal from the east to the west and that of U.S. coal from the west ot the east have to take a 2,000-kilometer journey. If Shanxi coal is vigorously exploited and utilized, the province will become China's Ruhr. He also pointed out: Not only should Shanxi be built into an energy base but it should also be built into one of China's heavy chemical industrial bases. It is necessary to set up coal-based chemical industrial projects, to build hydropower stations, and to develop high energy-consuming and less water-consuming industries.

Then the scope and development orientation of energy bases were basically defined.

To break through the limitations of the existing economic management structure and to readjust the relationships between different local administrative areas, between different central departments, and between central departments and local administrative areas, at the end of the same year, the State Council gave its official approval to the establishment of an energy base planning office which specially took charge of the coordination and planning of energy bases on behalf of the State Council. The office was headed by Guo Hongtao, vice minister in charge of the State Economic Commission and a specialist in transportation and communications.

Three Steps To Be Taken in Energy Construction Bases

To build such huge energy bases is an unprecedented job for China. One can well imagine the difficulty of the task. Of the numerous difficulties, two are most striking. One is that the region where energy bases are to be located

is China's "third world" which has a comparatively weak economic foundation and insufficient financial resources for carrying out large-scale development and construction. Moreover, the region is not supposed to rely entirely on state investment funds in doing so. The other is that the energy bases cover a developmental economic area encompassing provinces and regions and different trades as well. To carry out construction in a comprehensive and rational way, it is imperative to defy the existing economic management structure and some economic policies. For this purpose, the central authorities decided to carry out construction in the course of reform and explore a new road consonanc with China's national conditions and regional characteristics.

Through a thorough investigation and study and careful deliberations and evaluation and after an overall balance was achieved, the Energy Base Planning Office of the State Council worked out a three-step plan that stressed proceeding steadily and step by step.

In the first step, in organizing forces, the initiative of the state, the locality, and collective, and the individual will all be encouraged, lateral connections will be developed, and the region will be opened to coastal areas and other provinces and cities as well as to foreign countries. For example, we will selectively build big strip mines, renovate and expand old mining areas, and cooperate in various ways with other countries, such as building and operating mines using Chinese and foreign investments and accepting loans from foreign firms.

In the second step, as far as the development pattern is concerned, a strategy of "10 years for the region east of the Huang He and another 10 years for that west of the Huang He" will be adopted. In other words, during the 20 years between 1980 and 2000, in the 1st decade, attention will be focused on the development of the regions in Shanxi and Henan east of the Hunag He and in the second, while the development of the above regions continues, the development front will be extended to the vast region west of the Huang He to lay a foundation for large-scale development in the next century.

In the third step, in terms of planning and construction, small regional plans will be implemented within a huge energy base. Together with the departments and regions concerned, the Planning Office organized the coordination of coal, power, aluminum, water, and transportation facilities of the southeast Shanxi-Jiaozuo region. It has now been decided that Jiaozuo's related projects in coal, aluminum, and power are singly listed in the state investment plan as "group projects" to achieve the aim of comprehensive development and simultaneous construction. After that, efforts will be devoted to the undertaking of the comprehensive development of the Shenmu coal field in Shaanxi and the Dongsheng coal field in Nei Monggol, the all-round planning and construction based on overall consideration of the coal, power, and road projects in Nei Monggol's Jungar, and the planning of the transshipment of coal by railroad, road, and waterway and of the collection, loading, shipping, and unloading of coal.

Prospects

Although the overall planning program for the economic development of China's energy bases has not yet been officially announced, according to the briefings given by industry experts, there have been some inkling of the prospects of the development of the energy bases by the year 2000.

--Energy construction. Several coal production bases and thermal power bases are to be constructed. The coal production bases include power coal bases in Datong, Pinghuo, Yanbei, Shenmu, Fugu, Jungar, and Dongsheng; coking coal bases in Guijao, Fenxi, Huoxian County, Xiangning, Liulin, Lishi; and Pingdingshan; and antracite bases in Yangquan, Jincheng, Jiaozuo, and Ruqigou. Of these, the Datong, Shenmu, Ruqigou, Xiangning, and Lishi coal mines will be turned into important coal export bases. It has been estimated that by the year 2000, the coal output of the energy bases as a whole will be double that of 1985.

The thermal power base includes large-sized power plants in Datong, Yanbei, in Shanxi Province, southeast Shanxi-Jiaozuo, Hequ, Baode, and Bianguan in southwest Shanxi, Jinzhong; in Yaomeng, Pingdingshan in Henan Province; in Jungar in Nei Monggol; in Dawukou-Haibowan where Ningxi and Nei Monggol meet; and in Weibei in Shaanxi Province. In addition, several ultra high-voltage transmission lines extending from Datong to Beijing's Fangshan and Shentou and through Hebei's Xushui to Tianjin, from Henan's Pingdingshan to Hubei's Wuhan, and from Pingdingshan to Zhengzhou will be built. By the end of this century, the total installed capacity of the energy bases as a whole will increase by approximately 300 percent over the current capacity and after meeting the needs the bases for power, some electricity will be transmitted to the Hubei and Zhongnan power networks.

--Transportation and communications construction. Three major coal-shipment rail trunk lines in the north, central, and south will be built. The north passage includes the Baotou-Beijing, Datong-Qinhuangdao, Yuanping-Beijing, and Jining-Tongliao lines. The central passage includes the Taiyuan-Shijiazhuang line and a line running from Shenmu to coastal ports via Suoxian County, Shijiazhuang, and Hengshui. The south passage includes the Xi'an-Shijiusuo line running through Houma, Xinxiang, Heze, and Yanzhou and the Shenmu-Jicheng line running through Yan'an, Xi'an, Bazhou in Ankang, and Jiaozuo. In addition, the existing roads will be renovated into grade-2 or grade-3 roads. Coal shipment through the waterways of the Huang He and pipelines will also commence.

--Construction of high energy-consuming raw and semifinished materials industries. The Bautou, Taiyuan, and Wuyang iron and steel plants and a number of local small and medium-sized steelworks with favorable conditions will be selectively renovated and expanded to double and redouble their steel output. The strengths of the base's aluminum resources will be given full play. While the existing aluminum plants are being renovated and expanded, the continuation and construction of several large-sized aluminum plants

will be started, including 1-million-ton-class alumina and 100,000-ton-class electrolytic aluminum plants. When they are complete and commissioned, the base's capacity to produce alumina and electrolytic aluminum will be several times greater than it was in 1985. A number of large-sized chemical plants using coal as the main resource and combined chemical enterprises engaged in the production of calcium carbide, caustic soda, soda ash, and polyvinyl chloride will be built or set up in the base's five provinces and regions. The replacement of fuel methyl alcohol and its by-products by gasoline will also start soon.

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NATIONAL POLICY

## BIG FOREIGN LOANS TO COVER MINE EXPANSION, POWER PLANTS

OW301422 Beijing XINHUA in English 1158 GMT 30 Nov 86

[Text] Beijing, 30 Nov (XINHUA)--China will use 2 billion U.S. dollars in loans from Japan and Italy and the World Bank to expand its coal industry during the 1986-90 period.

A coal industry ministry official told XINHUA that the money will be used to build or enlarge coal mines to produce 33 million tons a year, coal-fired power plants with a generating capacity of 1 million kilowatts and 200 kilometers of coal-shipping railways.

Work has started or will begin soon on the Jungar strip mine to produce 12 million tons a year in Inner Mongolia, two mines to produce 9 million tons annually in Jinin, Shandong province, and another two each to produce 4 million tons a year in Shanxi and Hebei provinces.

The official said that China used 1.5 billion U.S. dollars in foreign funds for its coal industry during the 1981-85 period.

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NATIONAL POLICY

WORLD PRICES, SHIPMENT CUTBACKS HURT EXPORT EARNINGS

HK290332 Beijing CHINA DAILY in English 29 Dec 86 p 2

[Report by staff reporter Xie Songxin]

[Text] Declining world oil prices and overseas shipment cuts reduced China's oil export earnings by more than $3 billion this year, a senior official announced on Saturday.

The twin declines were the major reason why the China National Chemicals Import and Export Corporation (Sinochem) saw its exports nearly halved from last year's $7.4 billion to an estimated $3.8 billion this year, said Sinochem President Zheng Dunxun.

Final oil export figures for the year are not yet in, but they are expected to be far below last year's 15.1 million tons, which included refined petroleum exports, Zheng said.

China twice announced oil export cuts this year to coordinate with efforts by the Organization of Petroleum Exporting Countries (OPEC) to stabilize the oil market.

Chinese oil prices dropped by an average 51.8 percent this year on the world market, compared with 54 percent in the OPEC countries, whose combined loss is expected to be $50 billion this year, Zheng said.

Meanwhile, China imported 2 million tons of crude oil and refined petroleum this year from Iran, Kuwait, and Indonesia at "reasonable prices" to help the country and assist OPEC efforts, Zheng said.

Reduced oil exports and price drops forced Sinochem, China's sole oil importer and exporter, to give up the position of leading Chinese exporter to the China National Textiles Import and Export Corporation, which is expected to export $5.3 billion worth of textiles by the end of the year.

However, the corporation is still the country's leading foreign trader if its imports are counted. Its total imports and exports are expected to reach $6.7 billion this year.

While oil exports decreased this year, Sinochem's chemical exports will hit a record high of $700 million, an increase of 31 percent over last year, Zheng said.

Zheng attributed the success to strengthened cooperation between foreign trade, transport and industrial organizations, flexible dealings and improved product varieties and quality.

The corporation re-exported 460,000 tons of imported crude oil this year. It also purchased 20,000 tons of phosphate from Syria and sold them to Finland, Zheng said.

It set up six overseas organizations this year. Currently, it has 19 foreign organizations, operating mostly in oil and chemicals markets.

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# PROGRESS NOTED IN PREPARATION, COMBUSTION TECHNOLOGY OF COAL SLURRY

Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] in Chinese No 7, Jul 86 pp 26, 48

[Article by the Chinese Coal Processing and Utilization Association]

[Text] A high-consistency coal-water slurry is an oil-substitute coal fuel which has been developed since the early 1980's. It is made up of 70 percent coal powder, 30 percent water, and a proper amount of additives. It can be stored, transported, pumped, atomized, and burned just like petroleum and there is no need to dewater it for burning in conventional oil-fired industrial furnaces and boilers. It creates far less atmospheric pollution than coal combustion and is referred to as a clean oil-substitute energy resource. Its heat value is equal to 1/2 that of oil. Sweden and the United States exploited it rather early and have now built slurry plants with annual productions of 250,000 tons and 200,000 tons respectively; they are now conducting tests in 20 steam ton/hour and 30 steam ton/hour boilers. Canada, Japan, West Germany and other countries have also made considerable progress and are now in mid-level testing phases.

In China, different types of coal from Shanxi, Liaoning, Shandong, Hunan, Shaanxi, and other regions have undergone numerous slurry-making and combustion tests with rather good results. As of now, four successive tests have been conducted for an accumulative total of 161 hours (of which one test was 72 hours), and 564 tons of slurry has been consumed. Preparations are now being made for industrial tests and it is estimated that the testing will take 500-700 hours and consume approximately 2000-3000 tons of slurry.

## Coal-Water Slurry Preparation

Manufacturing a coal-water slurry comparable to liquid fuel requires that the ash content in the slurry to be less than 6 percent, the sulfur content to be less than 1-2 percent, the volatile matter to be greater than 30 percent, the melting point be greater than 1300°C, the maximum size be less than 300 microns, and that -200 mesh coal comprise more than 70 percent. Qualitative indices for the coal-water slurry are that the dry coal weight comprise 65-75 percent; at 25°C and when the shear rate is $100^{S-1}$, the viscosity is 1000cP; its stability is for more than 3 months, so during long periods of storage or transportation, there are no hard precipitates. The main requirements are that

its consistency be high, its viscosity low, and its stability good. To reach these requirements particle size mixing and suitable chemical additives must be resolved. The additives can make the coal particles' surface hydrophilic, so that the particles are fully dispersed in the water, and raise the stability of the coal-water slurry.

## Coal-Water Slurry Combustion

Although coal-water slurry contains 30 percent water, the heat value needed to absorb the water evaporation only makes up 3-4 percent of the total slurry heat value. After the presence of water vapor and evaporation, the coal slurry droplet reaction area increases, but it can quicken the combustion process and promote combustion.

In order to burn completely, it is necessary to atomize the slurry into fine slurry droplets, and the time needed for the slurry droplets to be burnt to ash and the diameter of the slurry droplet are in direct square proportion. The vortex spray heads used in the tests had to ensure that there was enough air for the atomized slurry droplets so that they could be completely burned. Utilizing blowers to force the air into close contact with the slurry mist and to mix the slurry droplets and the air also forms a vortex and extends the time that the slurry droplets remain in the boiler chamber. The center of the vortex creates negative pressure and a return current; the new slurry mist enters the return current causing the water vapor and volatile matter to separate and burn. This is the effect of the primary blast and comprises about 10-20 percent of the total air volume. The secondary blast is the air volume needed to burn to ash, the volatile matter, and fixed carbon contained in the slurry and comprises 80-90 percent of the total air volume. The primary and secondary blasts preheats the air to 200-300°C in order to raise the flame temperature and to fully utilize the thermal energy.

When oil-burning boilers are altered to burn coal-water slurry, improvements to the boiler include: 1) Enlarging the air preheaters. Under identical heating value conditions, burning coal-water slurry uses about 20 percent more air than required in burning oil, and when the air is preheated to 200-300°C, burning the coal slurry can cause the boiler chamber temperature to reach 1350°C-1450°C; 2) A tertiary blast is added in the upper section to send the preheated air directly to the upper section of the boiler chamber so that the slurry will burn more fully in the boiler; 3) Water is added in the lower section of the boiler chamber to cool the boiler discharge and prevent the falling ash from slagging. In addition, a tertiary blast is added in the lower section to blow the falling ash up and out along with the smoke; and 4) Dust collectors are added so that the ash content in the smoke after dust collection can meet the standards of environmental regulations.

## Economic Benefits of Coal-Water Slurry Oil Substitutes

The cost per ton of coal in America is U.S. $30 and the price after it has been made into slurry is U.S. $60. The price per ton of oil is U.S. $170 and the heating value of 2 tons of coal slurry is equal to 1 ton of oil. For each ton substituted for oil, U.S. $50 is saved. The development of coal-water slurry

has been restricted by government energy resources policies and pricing policies. Although China has set the substitution of coal for oil as a basic energy conservation policy, price-wise there still exist irrationalities. In the plan, the price for burning oil is 125 yuan/t, but the price for coal-water slurry is 120 yuan/t. To achieve the same heat value, 240 yuan would be needed, therefore coal-water slurry substitutes for oil is not worthwhile. But for units using negotiated oil prices, the heavy oil price is 500-600 yuan/ton and residual [fuel] oil is 300 yuan/ton; a coal-water slurry substitute would be fairly good. Taking a paper mill as an example, after the boilers which originally burned residual oil are converted to burn coal-water slurry, nearly a million yuan can be saved each year. Coal-water slurry is a new technology and burning it in boilers has just begun and there are many questions that will be resolved in practice.

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POWER NETWORK

## POWER OUTPUT OUTSTRIPS INDUSTRIAL GROWTH

OW101731 Beijing XINHUA in English 1503 GMT 10 Dec 86

[Text] Beijing, 10 Dec (XINHUA)--China's electric power output was up 9.4 percent in the first 11 months of this year, outstripping the country's industrial growth, which was 8.4 percent, the Chinese Ministry of Water Resources and Electric Power announced here today.

This will help change the situation in which power output has lagged behind industrial growth since 1980, a ministry official said.

China produced a total of 405.2 billion kWh of electricity in January-November, this year, the ministry said, adding that the country expects to produce 445 billion kWh. The production target for this year is 430 billion kWh.

The annual plan for the country's hydroelectric power generation has been completed 26 days ahead of schedule, and the power output of the thermal power producers was 11.2 percent greater in the January-November period than in the same 1985 period, the ministry said.

The ministry official noted, however, many areas across the country are still short of electricity and efforts should continue to increase the supply in these areas.

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CSO: 4010/21

POWER NETWORK

## MACHINE-BUILDING INDUSTRY GIVES STRONG SUPPORT TO POWER SECTOR

Beijing ZHONGGUO JIXIE BAO in Chinese 16 Oct 86 p 1

[Summary] The Five-Million-Kilowatt Leading Group of the Ministry of Machine-Building Industry has recently urged all factories engaged in the 5-million-kilowatt power generation equipment program to guarantee that the mission be completed on schedule.

As of the end of September 1986, eight power facilities with a total installed capacity of 865,000 kilowatts had formally gone on stream and an additional six facilities representing a combined capacity of 900,000 kilowatts were actually running and expected to become fully operational in the near future. At the same time, 95 percent of the generating equipment, cables, insulators, and meters needed for the power stations and their associated transformer and transmission projects had been completed.

The following deliveries were scheduled by late October 1986:

Oxygen-removing equipment for the Dawukou No 3 generator (manufactured by the Wuhan Boiler Works);

The main rotor and hydraulic turbine wheel for the Taipingwan No 3 generator (manufactured by the Harbin Electrical Machinery Plant);

The current regulators for the Hefei Power Plant (manufactured by the Shanghai Electrical Machinery Plant);

A 210KVA transformer for the Dawukou No 3 generator, a 31,500KVA transformer for the Shajiao No 1 generator and a 90,000KVA transformer for the Longxi substation (manufactured by the Baoding Transformer Plant);

An 18-ton hoist for the Jinshuitan No 1 generator (manufactured by the Kuangshan Machinery Plant in Luoyang);

I-series meters for the Shajiao No 1 generator (manufactured by the Xi'an Meter Plant).

Items scheduled for delivery in November 1986 include:

High-pressure heating equipment and valves for the Hefei Power Plant (manufactured by the Shanghai Electric Power Plant Auxiliary Machinery Factory);

Circuit breakers for the No 11 generator of the Gezhouba Hydropower Station (manufactured by the Shenyang High-Voltage Switch Factory).

Among the power projects slated to go on stream in the first half of 1987 are:

The No 12 and No 13 generators for Gezhouba (2 x 125,000 kilowatts);

The No 3 and No 4 generators for Yuzixi (2 x 40,000 kilowatts);

The No 4 generator of Hongshi (50,000 kilowatts);

The No 3 generator for Jinshuitan (50,000 kilowatts);

The No 1 generator for Changtan (15,000 kilowatts);

The No 9 generator for Nanshi (25,000 kilowatts);

The No 10 generator for Jianbao (300,000 kilowatts);

The No 1 generator for Shiheng (300,000 kilowatts);

The No 8 generator for Douhe (200,000 kilowatts); and

The No 3 generator for Wulashan (100,000 kilowatts).

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## SHANXI POWER SECTOR UNDERGOES ENORMOUS GROWTH

Taiyuan SHANXI RIBAO in Chinese 3 Oct 86 p 1

[Article by Zhao Pengling [6392 1756 7881] and Tai Jinzeng [6733 6855 1073]: "Shanxi's Electric Power Developing Rapidly; Electricity Generated in 1 Day Today Equal to Total Electricity Generated in 1949"]

[Text] Shanxi's electric power industry is growing swiftly and fiercely, and the situation is gratifying. From January to August of this year, Shanxi generated 13.66 billion kWh of electricity, an increase of 40 percent compared to the same period last year. Today, the electricity generated in one day throughout the province is equal to the total electricity generated in 1949.

From 1908 to 1949, the installed capacity of Shanxi's electric power industry was only 39,000 kW and the annual generation of electricity was 63.29 million kWh. After 1949, Shanxi successively built or expanded 15 large and medium-sized power plants such as the Taiyuan No 1 No 2 power plants, the Datong No 1 No 2 power plants, the Shentou power plant, the Niangziguan power plant, the Huoxian power plant, the Zhangze power plant and others as well as 69 small thermal power plants and small hydroelectric stations and self-sufficient power plants. The new increase in installed capacity is 3,814,700 million kW and the electric generating capacity has increased 97.8 times since 1949. During the Sixth Five-Year Plan the rate of construction was continually speeded up for the Datong No 2 power plant, the Shentou power plant, the Zhangze power plant and other key national projects, and, in those five years, 1,452,000 million kW of capacity were installed, ranking first throughout the country. The electricity generated in 1985 totalled 18.42 billion kWh, an increase of 290 times over that of 1949. Power network construction has grown from nothing, to a large system in which power lines are distributed throughout the province.

Shanxi's small thermal power plants and small hydroelectric stations surround the large and medium-sized power plants and their associated substations and power distribution systems that support agriculture farmers are spread througout the province. In 1978, every county in the province was electrified; in 1983, electrification of every township was achieved. By last year, 85 percent of the villages throughout the province were using electricity. The average amount of electricity used by the rural population throughout the province reached 110.9 kWh, ranking in the upper levels throughout the country.

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## BRIEFS

HEILONGJIANG TRANSMISSION LINE--A 220,000-volt high-tension power transmission line between the towns of Lishu and Muling in Heilongjiang Province went into operation on 21 October 1986. This power transmission line is 73.4 km in length. [Excerpt] [Harbin HEILONGJIANG RIBAO in Chinese 6 Nov 86 p 2 SK] /9738

KEY LIAONING SUBSTATION--The Lingyuan primary transformer substation, a key construction project in Northeast Power Grid, was completed and went into operation on 11 November. This transformer substation was jointly built by Northeast Power Grid and the Lingyuan transformer subbureau with a total investment of 9.42 million yuan. [Excerpt] [Shenyang Liaoning Provincial Service in Mandarin 1030 GMT 19 Nov 86 SK] /9738

LONGYANGXIA FORCES ELECTRICITY RESTRICTIONS--Due to the fact that Longyangxia Reservoir in the upper reaches of the Huang He is retaining water, the hydroelectric power plants, including Liujiaxia, are reducing electricity output, from 15 November to the end of January 1987, Gansu Province will restrict the use of electricity to 4.5 million kilowatt-hours each day. Therefore, the Provincial Economic Commission demands that electric power departments properly readjust the supply of electricity throughout the province, strengthen enterprise electricity grid management, and strictly enforce electricity grid discipline. Winter irrigation for agriculture, which requires electricity, must be completed before 15 November. [Summary] [Lanzhou Gansu Provincial Service in Mandarin 1100 GMT 13 Nov 86 HK] /9738

SHAANXI 330KV LINE OPERATIONAL--On 6 October, the 330KV ultra high-tension power line that runs from Hua Xian through the northern outskirts of Xi'an and to the substation at Xingping was officially put into operation. The line has a total length of 165 kilometers and a transmission capacity of 400,000 kilowatts. The Qinling power plant is the largest thermal power plant in the northwest. After its newly added 200MW generator became operational in early October, the plant's installed capacity grew to 1.05 million kilowatts, 800,000 kilowatts of which go out on 330KV lines. This new transmission line will not only help resolve the energy demands of industry and agriculture in the Xi'an area, but will also enhance the stability of the northwest grid in a major way. [Excerpts] [Xi'an SHAANXI RIBAO in Chinese 10 Oct 86 p 1] /6091

SHANDONG OUTPUT UP--The Shandong power grid has prefulfilled its production plan by 32 days this year thanks to the enforcement of responsibility systems. As of 29 November, the provincial power grid generated 25.751 billion kilowatt-hours of power in each quarter, a 14-percent increase over the figure for the corresponding 1985 period. [Excerpt] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 3 Dec 86 SK] /9599

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## UNITS EXHORTED TO COMPLETE 7TH FYP MISSION

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 8, 12 Aug 86 p 6

[Article by the Engineering Quality Management Work Conference Convened by the Central Water Conservancy and Hydropower Construction Bureau: "Concentrate on Quality First and Improve Economic Results for Better Completion of Water Conservancy and Hydropower Construction Tasks in the Seventh Five-Year Plan"]

[Text] To strengthen water conservancy and hydropower construction quality management work, the Central Water Conservancy and Hydropower Construction Bureau convened the "Water Conservancy and Hydropower Engineering Quality Management Work Conference" in Beijing during June 1986. During the meeting, the delegates studied the related documents, reexamined quality management work over the past few years, and exchanged experiences. On this foundation, they discussed, examined, and approved several documents concerning reinforcement of quality management work in the spirit of reform and also commended and rewarded a group of superior designs, superior quality projects, superior quality products, and groups and individuals that have exhibited superior quality management. Leading comrades from the State Planning Commission Design Bureau and Construction Bureau, the China Engineering Construction Quality Association and the Ministry of Water Resources and Electric Power spoke at the conference. At the end, Comrade Zhu Erming [2612 1422 2494] gave a concluding address on behalf of the Central Water Conservancy and Hydropower Construction Bureau.

The opinion of the conference was that since the 3d Plenum of the 11th CPC Central Committee, and especially since the 1983 Quality Managemnet Work Conference, the overall quality of water conservancy and hydropower projects (designs and products) was rather good and that the trend was a consistent and stable improvement. There has been, for example, a rather substantial increase in the rate of superior engineering products in recent years and several excellent designs, superior quality engineering and outstanding products have appeared. The stages and construction at projects and power generators at Gezhouba Da Jiang [main river], Baishan, Hongshi, Taipingwan, and other places have been examined and accepted and they are operating normally. Basic level work has been strengthened and new reforms in quality management work are underway. Some basic experiences and methods involved for superior designs, projects and products, and quality work that has been done rather well include: attention by leadership and a strong concern for

quality; cooperation with one heart and close coordination between design and construction units to ensure quality; an emphasis on high standards and strict requirements; perfected quality responsibility systems and a sense of mastery of one's affairs; reinforcement of basic level work and a serious "three inspection" system; and leadership support for quality inspection personnel, strict responsibility for positions, considerably strong flexibility for quality management groups, with obvious economic results. These achievements have been accompanied by quite a few problems, especially the considerable lack of adaptation to the development of reforms in economic systems. This began in the last quarter of 1984 and is manifested in fluctuations in the quality of design and engineering and an increase in quality accidents. Incorrect guiding ideologies and lax management are the causes of these problems.

To improve the quality of projects, designs and projects, the conference indicated clearly that the following problems must be dealt with: (1) We must correct guiding ideologies and work earnestly to implement the principle of "quality first." The current tendency toward a concern only for advances to the neglect of quality must be reversed quickly. All units and leaders at all levels should examine the guiding ideology of management in their units. In the area of survey design, we must give primacy to the completion of state plans and assure that all state directive plan tasks assigned by the ministry and the central bureau are fulfilled, both in quality and in quantity. ' Tasks undertaken outside of plans should be managed responsibly and on the basis of capabilities. In the area of project construction, all units should vote to undertake contractual responsibility and participate in competition in conjunction with making scientific and rational arrangements in leadership forces and technical professional forces and guaranteeing the completion of project construction tasks in both quality and quantity. (2) Establish quality supervision systems, perfect quality inspection systems, and improve quality assurance systems, mainly through quality supervision stations. Water conservancy and hydropower projects are large scale ones, and they involve many aspects, are technically complex, and touch on a broad range of things. Assuring the quality of projects requires the establishment and perfection of "three major systems," guideline for the forms in quality management systems. In addition, there should be industry supervision and industry management, which is the principle of future development. This requires that the Central Water Conservancy and Hydropower Construction Bureau establish the corresponding quality supervision organs. (3) Strengthen education on quality and improve the understanding of quality. The primary task of design academies and of construction and manufacturing enterprises is to produce quality products and assure that every employee is aware of this point. The formulation and reform of all systems of regulations, measures, methods, and work standards should be focused on reinforcing people's understanding of quality and assuring progress in superior quality projects. (4) Have strict requirements and reinforce quality management. All design academies should have fairly complete technical and management systems and there should be specialized organs and specific specialized personnel to take responsibility for the quality of design and focus on technologies. Designs that do not meet quality standards specified by the state should not be issued. Construction units should build according to plans and they should welcome supervision

and agree to inspections. (5) Work actively to extend comprehensive quality management and apply modernized technologies. All units should focus earnestly on work in quality management groups, strengthen leadership, come up with good topics, summarize experiences, and gradually extend them. (6) Strengthen employee training and improve staff quality. Hold special classes on quality management in polytechnic schools during the last half of 1986 and strive to hold them in colleges and universities during 1987. All units should deal with various long- and short-term special and on-the-job classes and strive to improve the quality of employees and staffs.

The conference concluded by pointing out that the goals and tasks of water conservancy and hydropower construction during the Seventh Five-Year Plan are specified clearly. The total scale of hydropower construction over the 5-year period will be 18.80 million kW, with 8 million kW in installed generating capacity under construction going into operation, so the tasks are both difficult and glorious ones. It is hoped that all related units will adhere to quality first, improve economic results, and strive to create even greater numbers of superior designs and projects and make the requisite contribution to even better completion of water conservancy and hydropower construction tasks during the Seventh Five-Year Plan.

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## MAJOR ACHIEVEMENTS IN KEY HYDROPOWER PROGRAMS IN 6TH FYP

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 8, 12 Aug 86 pp 4-5

[Article by Chen Zongliang [7115 1350 4731] of the Ministry of Water Resources and Electric Power Science and Technology Department; "Major Achievements in State Efforts to Solve Key Problems in Hydropower Science and Technology During Sixth Five-Year Plan"]

[Text] Large numbers of scientific and technical personnel have expended a great deal of effort concerning key state hydropower science and technology tasks undertaken by the Ministry of Water Resources and Electric Power during the Sixth Five-Year Plan and they have been completed according to plan. Some 340 S&T achievements and 27 new instruments and equipment have been examined by expert groups and all have received approval. Because these achievements are closely integrated with project realities, the economic and social benefits that were attained during the key research stage alone are quite apparent and preliminary estimates are that they will save about 60 million yuan. The extension and application of these achievements in hydropower construction throughout China in the future will create even greater benefits.

The key hydropower projects of the Sixth Five-Year Plan were: techniques for developing new energy resources, key technologies for constructing tall earth and rock dams, technologies for building dams on deep and thick capping strata, stabilization and support technologies for the rock around large underground chambers at hydropower stations, key technologies for speeding up underground projects at hydropower stations, applications of tunneller technologies, exploration of complex foundations and research on engineering geology, and design and construction to deal with complex foundations. The main units responsible for key hydropower projects included: the Water Conservancy and Electric Power Research Academy of the Ministry of Water Resources and Electric Power, the Chengdu Prospecting and Design Academy of the Ministry of Water Resources and Electric Power, the Kunming Prospecting and Design Academy of the Ministry of Water Resources and Electric Power, the No 14 Engineering Bureau of the Ministry of Water Resources and Electric Power, the Chang Jiang Basin Planning Office, the Geological Prospecting Basic Processing Company of the Ministry of Water Resources and Electric Power, the Zhejiang Province Science and Technology Commission, and the Zhejiang Province Electric Power Industry Bureau. Many other cooperating units also participated in the attacks on key problems. Because of the

rather substantial number of achievements made in key hydropower tasks during the Sixth Five-Year Plan, I will introduce only some of the achievements below.

1. The Jiangxia experimental tidal power station was completed. China is relatively rich in tidal energy resources and the Jiangxia experimental tidal power station was built to explore experiences in the integrated development and utilization of this energy resource. This power station is located in Jiangxia Harbor, Wenling County, Zhejiang Province. Now fully completed, it has a total installed generating capacity of 3,200 kW and is generating power. This is China's largest tidal power station. The main achievements made through attacks on key problems were: (1) Successful development of two new types of multifunction experimental generators that filled in a blank area for this type of generating equipment within China. Operational testing has proven that the generators are of excellent quality and that they approach advanced world levels. (2) Experience has been gained in marine engineering structural design, construction and operation, the prevention of generator contamination and corrosion, and other areas. An example is the seawall project built on silt and clay marine facies sediments with a load-bearing capacity of less than 0.1 kg/cm. The water level on either side rises and falls substantially four times a day. After study, primary and auxiliary stone-filled body clay-core wall dikes were selected. Long-term testing of the seawall since its completion has proven it to be stable and reliable and no problems of uneven settling have been encountered. Another example includes research on the use of negative electrode protection, electrolytic seawater protection and other new technologies in the generators and flow channels that successfully solved key technical problems like attachment of marine organisms, seawater corrosion, and so on. (3) A basic understanding has been gained concerning laws of silt accumulation and measures for preventing silt accumulation in power station reservoirs. Large amounts of testing and research work on tidal characteristics and the laws on silt motion have been carried out since the dam and power plant buildings began operating, and research focused on operation patterns has assured that there has been no apparent silt accumulation within or outside of the power station reservoir. The benefits of the experimental power station have become quite apparent since its completion. It has generated an average of 10 million kWh each year and provided other comprehensive economic benefits that include aquaculture and the reclamation of 4,700 mu of arable land near the reservoir and others, with added social benefits in recent years exceeding 2.6 million yuan.

2. A scientific foundation has been provided for using soft weathered rock material as a leakage prevention material in tall earth and stone dams. In conjunction with the question of leakage prevention materials at Lubuge, Tianshengqiao and other tall earth and stone dams, there has been research focused on the utilization of weathered materials as a substitute for conventional clay materials to expand sources of materials, obtain materials locally and decrease project costs. The main attacks on key problems include research on the mineralized components, strength and deformational characteristics of earth, leak prevention and crack self-sealing capacities, the basic characteristics and mechanical characteristics of back filter

materials, computing and analysis methods, construction techniques and the related construction parameters, and so on. After a large amount of laboratory and on-site experiments and computer analysis, a comprehensive and systematic scientific foundation for the use of weathered material as a leakage prevention material in tall dams has been proven and practical results have been obtained. This technology has been employed in the rock-fill dam at the Lubuge hydropower station and may conserve more than 3 million yuan in project investments compared with conventional methods. This is a new advance in materials used to construct tall earth and rock dams in China and will be extended and employed in other earth and stone dam construction in the future. There is no doubt that the economic benefits are substantial.

3. We have gained a basic understanding of new techniques for taking samples from deep and thick capping strata. Many riverbeds in southwestern China have deep and thick capping strata. The primary problem involved in the construction of dams on this soft foundation is to understand the basic qualities of deep and thick capping strata and therefore to solve problems of sampling techniques. In combination with actual problems with deep and thick capping strata at the base of the dams at the Tongjiezi and Taipingyi hydropower stations, research was carried out on sampling techniques and dam construction techniques in drifting pebble capping strata in riverbeds. Major scientific and technical achievements to date include: (1) A successful understanding of nonsolid phase flushing liquid protection walls in combination with diamond drilling techniques that can extract cylindrical samples almost undisturbed from thick sand strata, interbedded mud strata and other conditions in sand and pebble strata, with an extraction rate that can exceed 70 perce This technique not only can solve problems with random sampling in cappi trata but also can be used to improve drilling techniques and reduce wear diamond drill bits, so it has major economic value. The newly developed S nt gum is a nonsolid phase flushing liquid material that also serves as a i-function grout processing agent. It is a new type of material used for the first time in China to prevent collapse during exploratory drilling. (2) In the area of dam construction on deep and thick capping strata, centrifuge modeling experiments on an enormous scale have been carried out in conjunction with processing in the deep trough on the left side of the Tongjiezi hydropower station for scientific proof of the technical feasibility and economic rationality of substituting load-bearing leakage prevention walls and inclined wall stone fill dams for programs involving deep excavation of capping strata. The adoption of this technique alone can conserve about 30 million yuan in project costs. This also is the first time that centrifuge modeling experiments on an enormous scale have been carried out in scientific research work concerning hydropower.

4. New advances have been made in key underground engineering design and construction techniques. A large amount of research was done in conjunction with underground plant buildings at Lubuge and the three cascades on the Xi'er He. This includes classification of the rock surrounding underground projects at hydropower stations, stabilization and support technologies for the rock surrounding underground chambers, stress and deformation characteristics of surrounding rock, various types of modeling experiment techniques, all sorts of mathematical research methods, new practice in the Oetling freezing method,

mechanized construction technologies, and so on. Major achievements already made include: (1) A comprehensive evaluation method for the rock surrounding underground projects and differential screw calculation of grades that have absorbed the best aspects of Chinese and foreign classifications for surrounding rock in conjunction with the characteristics of underground projects in Chinese hydropower stations. Preliminary feedba .k and application of geological surrounding rock classifications from 35 projects have yielded satisfactory results and a preliminary decision has been made to try them out in underground engineering designs at hydropower stations throughout China. (2) Finite element and stress coefficient regression analysis methods and in situ test chamber inversion methods and so on. These methods have provided rational methods for analyzing ground stress fields. On this basis, a rational readjustment was made in the site of the underground plant building at Lubuge and complete spray anchor structural supports employed in underground engineering in the area of the plant building may save about 7 million yuan in investments. (3) The new Oetling freezing method has been tested and utilized in the underground plant building in the three cascades on the Xi'er He and practical experience has been gained. More than 1,044 meters of tunnels have been completed at a savings of about 1.86 million yuan in investments over conventional methods, which provides an excellent foundation for extension and application of the new Oetling freezing method in the future. (4) In the area of mechanized construction, the importation and digestion of foreign construction machinery has led to continual improvements in construction technology standards in China. At Lubuge, the new records of a monthly progress of 245 meters in spreading extraction (and extraction of 14,500 cubic meters) in the lower parts of a tunnel 65 square meters in cross-section and pouring 9,840 cubic meters of concrete each month were attained, and they provide valuable experience for rapid construction.

5. Valuable practical experience has been gained in using tunneller technologies. A 5.8-meter Chinese-made tunneller has been used in conjunction with construction of the Gurenzhuang tunnel at the Luan He diversion project. Research has focused on construction techniques using tunnellers and comprehensive investigation of tunneller capabilities and the rationality of attaching rubble removal systems behind tunnellers. Exploration and continual summarization of construction experience has led to excellent results and provided practical experience in construction operations. Tunnelling progressed by 630 meters in 4 months' time in 1983 and average monthly progress exceeded 150 meters. In addition, a monthly progress record of 213 meters was created. Under rock bodies in which joints have developed and rock strata structures are flat, construction has been able to proceed in complete safety and it has revealed advantages of tunnellers like quickness, low cost, few instances of excessive or insufficient excavation, safe construction, and so on.

6. Gratifying achievements have been made in exploration and processing technologies for complex foundations. Attacks on key problems have proceeded in conjunction with several hydropower projects, the main topics including exploration machinery and tools, classification of the constituents and distributional regularities of soft and weak strata, physical mechanics qualities, engineering geology evaluations, and other areas. Major achievements to date include: (1) Large-diameter full cross-section drilling

technologies (including matching drill rigs and tools and the model $BH_{24}$ welded tooth hobbing cutters and underground deep water electromagnetic lifters suitable for use in hard rock) that have been used successfully in the Gezhouba and Taiyuan water well projects. They are rather substantial improvements over core drilling in terms of drilling rates, lower costs, improved working conditions, and other areas, and they can be used widely in processing construction foundations and drilling projects. (2) Successful development of 53mm diameter bore hole color television recording equipment. They have been used in practice in more than ten projects including Lubuge, Feilaixia, Xianghongdian, Jupitan, and others. The images provided by this recording equipment are clear and stable, of high resolution and good results, and they have widespread use value. Many problems were overcome during the research, including such things as small-scale camera probe deflection yokes and optical lenses for unusual types of light sources, fogging of glass windows, and so on. (3) In the area of dealing with complex foundations, research has focused on various processing methods centered on grout and there has been integration with research and foundation processing at the Longyangxia and Ankang hydropower stations. In addition, a new 150/150 hydraulic grout pump, a hydraulic grout drill and single hole, single-unit automatic grouting systems have been developed. Moreover, they can provide a centralized grout-making system supplying cement grout for 35 grouting machines operating at the same time with the 400 tons of dry ash consumed each day in the Longyangxia grouting project. This final achievement alone can save about 2 million yuan in investments at the Longyangxia grouting project.

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## WORK ON WAN'AN PROJECT GOES INTO HIGH GEAR

Nanchang JIANGXI RIBAO in Chinese 1 Oct 86 p 1

[Report by Ouyang Ruhuan, Hu Haiyang, and Shi Hehua: "Construction of the Wan'an Hydropower Station--a Key Project in the State's Seventh Five-Year Plan--Has Picked Up Speed and Is Now Going Into High Gear"]

[Summary] The atmosphere at the imposing construction site is keyed up. The officers and men of Wujing Hydroelectric No 2 Group, who bear the main responsibility for the project, are working in three shifts around the clock to see that this year's mission--which involves an investment of 85 million yuan and calls for pouring 300,000 cubic meters of concrete--is completed. According to comrades at project headquarters, as of the end of August more than 45 million yuan of this year's investment had been completed, and by the end of September 190,000 cubic meters of concrete had been poured. The foundation excavation for the power plant which started at the beginning of the year has been entirely completed, the earth dams are ready for filling, 83 percent of the locks construction is completed, and the pouring for the draft tubes for generators one and two is complete. The lowering of the water level during the fourth quarter makes it an ideal time for construction work, and in addition to fulfilling the year's pouring tasks in a manner that guarantees quality, they must also make an effort to do as much pouring as possible, so as to create advantageous conditions for next year's work.

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CSO: 4013/24

## STATE COUNCIL FORMS THREE GORGES INVESTIGATIVE COMMITTEE

Beijing GUANGMING RIBAO in Chinese 31 Jul 86 p 1

[Article: "Renewed Debate on Feasibility of Sanxia Project--Ministry of Water Resources and Electric Power Organizes Specialists To Conduct Intensive Study and Issue Report in Spring 1987"]

[Text] According to a report in the overseas edition of RENMIN RIBAO, the CPC Central Committee and the State Council recently decided to renew the debate on the feasibility of the Sanxia project. The Sanxia Project Investigation Commission, chaired by Vice Premier Li Peng and with Song Ping and Song Jian serving as vice chairmen, was set up in Beijing to assume responsibility for investigating the new feasibility report. In June, the Ministry of Water Resources and Electric Power established a Sanxia Project Discussion Leadership Group to organize specialists in all fields to carry out the renewed discussions. To solicit opinions from all areas, the CPC Central Committee has established a special Sanxia Project Coordination Group to assume responsibility for coordinating the discussions. This group is composed of persons from the State Council, the CPC Central Committee Central Advisory Commission, China People's University, and the Chinese People's Political Consultative Conference.

The Chang Jiang Sanxia project is an enormous project that has attracted world attention, and the CPC Central Committee and State Council have been extremely concerned with this work. Relevant departments and scientific and technical personnel in China have done a great deal of exploration, scientific research, and design work concerning the Sanxia project over the past 30-plus years and they have accumulated substantial amounts of information. The State Council also has organized experts on several occasions for discussions and have approved the Sanxia project feasibility study report in principle. There are, however, some questions and new opinions concerning the project that require extensive economic and technical study. To achieve a greater detail of precision, accuracy, and stability in this project, the CPC Central Committee recently instructed the relevant departments and organized specialists in all fields to encourage technical democracy and full discussion and resubmit a feasibility study report on the Sanxia project on the basis of intensive research and discussion.

The actual work of discussing the project will be the responsibility of a Sanxia Project Discussion Leadership Group, headed by Qian Zhengying under the Ministry of Water Resources and Electric Power. The group held its first meeting in Beijing in late June and discussed the goals, methods, content, outline of stages, and organizational structure of the discussions.

The expert group composed of specialists from all fields will carry out intensive research on ten topics including geology and seismology, hydrological structures, silt, shipping, the ecological environment, investments and resettlement to carry out new feasibility discussions and propose guiding opinions and requirements. It has been predicted that the renewed feasibility study work on the Sanxia project will be completed by the end of March 1987 and that at that time the Sanxia Project Discussion Leadership Group Ministry of the Water Resources and Electric Power will propose another feasibility report and submit it to the Sanxia Project Investigation Commission.

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# FACTORING COMPREHENSIVE BENEFITS INTO ASSESSING HYDROPOWER ECONOMICS

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 7, 12 Jul 86 pp 6-8

[Article by Yu Fuqiu [0151 2421 4428] of the Danjiangkou Key Water Conservancy Project Management Bureau: "Assessing Comprehensive Benefits Is Essential When Evaluating the Economy of Hydropower"]

[Text] The "Re-evaluation of the Economy of Hydropower" focused on the evaluation of hydropower and drew the mistaken conclusion that hydropower was "uneconomical" and that "investments should be halved." Why? There are two main shortcomings in their method. The first is that they adopt unrealistic data to denigrate hydropower. The second is that they only consider the benefits from electrical power. This article will not discuss the first one and will only concern itself with an analysis of the comprehensive benefits of Danjiangkou to discuss problems of the second type that can be found in the "Re-evaluation."

The Danjiangkou key water conservancy project is a backbone project for the comprehensive control and utilization of the Han Jiang that provides comprehensive benefits like flood prevention, power generation, irrigation, shipping, breeding and so on.

The catchment basin above the Danjiangkou reservoir covers 95,200 square kilometers and has a long-term average annual runoff of 37.9 billion cubic meters. This includes 10.2 to 9.8 billion cubic meters of effective reservoir capacity that can be used for year-round regulation. The key project closed its gates and began storing water in 1967, the first generator began operating in 1968 and the main body of the project was completed in 1973. It has provided about 8 billion yuan in direct or indirect benefits over the past 10-plus years in the areas of flood prevention and development, which is 9.8 times more than the cost of building the project, and it has played an important role in promoting development of industrial and agricultural production and the national economy of Hubei and Henan Provinces.

## I. It Has Reduced the Danger of Flooding in the Middle and Lower Reaches of the Han Jiang

The effects of climate and terrain on the Han Jiang often lead to major flooding because of concentrated thunderstorms. The combination of continually declining drainage capabilities of the river channel as one

moves downstream in the middle and lower reaches and the absence of means to drain off floodwaters in the upper reaches meant that reliance on dikes along the river banks caused breaches and disasters. There were breaches of dikes in 15 of the 25 years between 1931 and 1955. The most severe one (of a severity seen every 100 years) occurred in July 1935 and caused 14 breaches in the middle and lower reaches. some 16 counties and cities below Guanghua were completely covered by water, more than 6.4 million mu of farmland was inundated, 300,000 homes were destroyed and 3.70 million people were affected, more than 80,000 of then drowned directly, so the disaster was extremely serious. Since the Danjiangkou key water conservancy project was completed and began storing water, there have been 51 instances in which floodwaters in excess of 10,000 cubic meters per second have flowed into the reservoir. The peak flow of 34,300 cubic meters per second occurred in october 1983, which is equivalent to flooding of a severity that would occur 1 autumn in 43. Some 13 of the 51 floods were completely contained and more than 50 percent of the peak floods were drawn off in 28 instances. There also were reductions to differing degrees for the remaining 10 instances. According to analysis, flood capture by the reservoir permitted the avoidance of flood diversion to Minyuan 16 times and to Dujiatai 25 times. This protected 11.1 million mu of cultivated land and river channel shoals and beaches from inundation and washouts and reduced losses by 3.8 billion yuan.

II. It Has Provided Peak Regulation Capabilities and Large Amounts of Electric Power

The Danjiangkou hydropower plant has an installed generating capacity of 900,000 kW and has generated a long-term average of 3.83 billion kWh each year, so it is a key power source in the Central China Grid. It not only provided large amounts of electric power but also has taken on the important tasks of peak regulation, frequency regulation, phase regulation and load and accident reserve.

The Danjiangkou hydropower plant generated a total of 62.2 billion kWh between the time the first generator went into operation in October 1968 and 1985, which conserved the equivalent of about 30 million tons of raw coal. Calculated at the unified state price for electric power, the value of output would be 4 billion yuan, which is 4.9 times greater than the cost of the project. The electricity transmitted by the Danjiangkou hydropower plant has brought about major changes in energy sources in Hubei Province and it has reduced raw coal imports to the province by more than 1.5 million tons each year. The flexibility and high degree of adaptability of operations at the hydropower plant have permitted it assume ever-increasing peak regulation tasks in the grid. After connection of the Henan and Hubei Grids in May 1979 , average peak load regulation by the Danjiangkou hydropower plant has increased from 214,000 kW in 1979 to 432,000 kW in 1985, which is more than 40 percent of the peak-to-valley differential in Henan and Hubei Provinces, so it plays a major role in improving the quality of power supplies in their electric power system.

A group of large thermal power generators have been built in the Central China Grid in recent years. Because of a rather substantial number of shortcomings found in these generators (and their boilers), the Danjiangkou hydropower plant often provides accident reserves whenever accidents happen. According to statistics for the period from May 1975 to December 1984, the Danjiangkou hydropower plant served a reserve role during grid accidents in 110 instances, which was an average of 11 times each year. The shortest period during which it served as an accident reserve was 1 to 2 days and the longest exceeded 2 months. Moreover, most of the accidents occurred during periods of flooding, so it has played an important role in providing safe electricity supplies in the electric power system.

III. It Has Guaranteed the Water Needed To Irrigate 3.6 Million Mu of Farmland in Henan and Hubei Provinces

Irrigation is one of the main tasks of the Danjiangkou key water conservancy project. It can serve as a source of water for 2.1 million mu of farmland in the Yindan [Dan Jiang diversion] irrigation district and 1.5 million mu in Henan Province. From the time that the irrigation district began drawing water until 1985, Hubei has brought in 2.9 billion cubic meters of water and irrigated a total of 8.73 million mu of land. Because a pattern of accumulation during slack periods and rapid use was adopted for drawing the water, this has permitted the irrigation district to fill its partially filled reservoir to the top and thereby transformed the water shortage and low output situation in the irrigation district. It has played a major role in promoting increased agricultural output and bumper harvests in Hubei Province. The irrigated area in the irrigation district has grown from 490,000 mu before the reservoir was constructed to the present figure of 1.26 million mu, which is 2.57 times the pre-reservoir figure. Total grain output has grown from the original 460 million jin to 1.05 billion jin. The irrigation benefits are extremely obvious.

Henan has irrigated a total area of 2.23 million mu from the time the Yindan irrigation district was completed up the end of 1984. It was especially important during the 45-day drought during August of 1981 in the irrigation district. Because the Danjiangkou reservoir was able to provide full irrigation, a bumper harvest still was attained in major crops (like wheat, corn, cotton, soybeans and others). Average yields per mu were up by 11 to 12 percent over 1980 and sesame seed output was up 87.5 percent. In another instance, no rain fell in the irrigation district between January and April 1983 and there was a serious drought. Because the reservoir assured that water (140 million cubic meters) could be drawn into the irrigation district during this period (from January to March) to fight drought on 318,000 mu, wheat yields increased by about 100 jin per mu.

In summary, the completion of the Yindan irrigation district has played an obvious role in the improvement of agricultural production conditions in Henan and Hubei Provinces and in promoting increased output and bumper agricultural harvests. The expansion in the area of the irrigation district and improved management levels over the years indicate that there will be an obvious increase in the benefits of irrigation in the future.

IV. It Has Improved Shipping Conditions on the Han Jiang

After the Danjiangkou key water conservation project was completed and went into operation, it played a major role in improving shipping conditions in the Han Jiang shipping channel and promoting the development of shipping channels in the upper and lower reaches, with benefits that are extremely apparent. The shipping channel between the large dam in the Danjiangkou reservoir region and Yunxian County was more than 150 kilometers long prior to construction of the reservoir. It was only 102 kilometers long after the reservoir was completed, so its length was reduced by almost 50 kilometers. This also improved shipping conditions in this stretch of the river and provided a minimum water depth of more than 3 meters. The shipping channel in the middle and lower reaches of the Han Jiang running from Danjiangkou down to Hankou extends for a total of 650 kilometers. Increased flows during the dry season have meant that the water depth of the line as a whole has risen by 0.2 to 0.5 meters, which increased the capacity of the shipping channel to pass ships so that 500 ton flotillas can move between Wuhan and Shayang, 350 tonners can reach Xiangfan and those of the 300 ton grade can reach Danjiangkou. Shipping had to be stopped for an average of about 1 month each year on the Han Jiang because of peak floods in the middle and lower reaches of the Han Jiang before the reservoir was built. After construction of the reservoir, flood peaks have been drawn off into the reservoir and shipping stoppages are very infrequent, with the amount of time the channel is open to the passage of ships being extended for nearly 1 month each year. Because of the large reduction in peak flooding in the middle and lower reaches of the Han Jiang after construction of the reservoir, the time period of intermediate water availability has been extended and the increased flow means that there are only minor changes in water levels during the dry season. The shipping draft is deeper, beaches and shoals have been reduced, the technical economic indices of the shipping channel have improved and there have been substantial improvements in the ship handling capacity of the shipping channel.

V. It Has Provided the Conditions for Developing Aquatic Production and Breeding Activities

After construction of the Danjiangkou reservoir was completed, a vast body of water covering 1.05 million mu (when the water level is 155 meters) was created upstream that provides favorable conditions for the development of breeding activities. Fish catches have grown yearly since the reservoir was completed, from 175,000 jin in 1969 to 3.8 million jin in 1985. If the fish raised in enclosures is added, yearly catches could total 4 million jin. The total catch over the 17 year period between 1969 and 1985 was 36 million jin. If steps are taken to reinforce management and administration and rational management systems are established, there could be even greater development of aquatic production and breeding activities.

If we consider the overall situation as outlined above, the benefits of comprehensive utilization since the Danjiangkou key water conservancy project was completed and went into operation are obvious. This is

especially true of the more prominent benefits like flood prevention, power generation and irrigation, which provide average yearly benefits of 500 million yuan. The direct and indirect benefits of Danjiangkou over the past 10-plus years total about 8 billion yuan. The benefits other than power generation account for 4 billion yuan or 50 percent of this amount. It is not certain that the non-power generation benefits of other large and medium sized hydropower projects will equal those of the Danjiangkou project but it is certain that they usually will provide comprehensive benefits. For this reason, we should make an accurate evaluation of comprehensive utilization of water conservancy and hydropower projects and should assess them not only by considering the direct benefits but also should take into account their undeniable social benefits. Only in this manner is a comprehensive and just conclusion possible. The "Re-evaluation," however, is somewhat superficial in this area, with the result that the conclusions it draws are erroneous ones.

12539/12781
CSO: 4013/166

## BRIEFS

TAIPINGWAN NO 2 UNIT OPERATIONAL--Shenyang, 18 Nov (XINHUA)--The No 2 generator unit of the Taipingwan hydropower station was put into operation on 14 November. The hydropower station, a Chinese-Korean joint project, which is located on the lower reaches of the Yalu River, will provide electricity to China and North Korea respectively with its total generating capacity of 190,000 kW and annual electricity volume of 770 million kWh. [Summary] [Beijing XINHUA Domestic Service in Chinese 0844 GMT 18 Nov 86 OW] /9599

HUNAN SMALL-SCALE HYDROPOWER--As of October 1986, the installed capacity for small-scale hydropower projects in Hunan Province reached 1.2 million kilowatts, placing the province in third place [nationally] following Guangdong and Sichuan Provinces. The installed capacity of small hydro projects in Hunan represents one-fifth of the province's total capacity. This demonstrates that Hunan's small-scale hydropower construction has moved into a new development stage. [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 25 Nov 86 p 3] /6091

SINO-JAPANESE FIRM WINS SHUIKOU CONTRACT--Fuzhou, 26 Nov (XINHUA)--A Sino-Japanese construction and engineering firm has won a contract to build a hydroelectric power station in Fujian Province. A letter of intent has been issued by the Fujian Provincial Power Industry Bureau to the Huatian Company which is jointly run by Maeda Construction Co. of Japan and the East China Hydroelectric Engineering Corporation. The firm's bid was selected over 10 others from foreign and Chinese contractors. The Huatian Company's tender was the best offer at 551 million yuan (150 U.S. dollars) [as received], bureau officials said. The selection was approved by the Chinese Ministry of Water Resources and Electric Power, the State Bidding Committee, and the World Bank. The World Bank will extend loans for the building of the project. Located at the lower reaches of the Minjiang River, the Shuikou Hydroelectric Power Station is designed to have a generating capacity of 1.4 million kilowatts and produce nearly 5 billion kilowatt-hours of power a year. The project is the largest in east China. [Text] [Beijing XINHUA in English 1029 GMT 26 Nov 86 OW] /6662

SHUIKOU UPDATE--Fuzhou, 26 November (XINHUA)--A Sino-Japanese construction and engineering firm has won a contract to build a hydroelectric power station in Fujian Province. A letter of intent has been issued by the Fujian Provincial Power Industry Bureau to Huatian Company which is jointly run by Maeda Construction Co. of Japan and the East China Hydroelectrical Engineering Corporation. The firm's bid was selected over 10 others from foreign and Chinese contractors. The Huatian Company's tender was the best offer at 551 million yuan (150 U.S. dollars), bureau officials said. The selection was approved by the Chinese Ministry of Water Resources and Electric Power, the State Bidding Committee, and the World Bank. The World Bank will extend loans for the building of the project. Located at the lower reaches of the Minjiang River, the Shuikou Hydroelectric power station has a design generating capacity of 1.4 million kilowatts and will produce nearly 5 billion kilowatt-hours of electricity every year. The project is the largest in east China. [Text] [Beijing XINHUA in English 1029 GMT 26 Nov 86 OW] /12232

CSO: 4010/23

## HUAINAN TO BECOME EAST'S LARGEST THERMAL POWER CENTER

Shanghai JIEFANG RIBAO in Chinese 9 Dec 86 p 1

[Excerpt] Although work on the first stage of the Luohe power plant has only just been completed, the two 300,000-kilowatt units now in operation have already produced close to 2 billion kilowatt-hours of electricity. By building large, modern pit-mouth power plants in this "ocean of coal," Huainan is now becoming the biggest thermal power center in East China.

Famous as a coal mining base, Huainan has newly verified reserves of more than 14 billion tons, more than two-thirds and one-third respectively than Anhui Province and Huadong. With a number of mines each capable of producing 3 million tons of coal year scheduled to go into production one after the other, after the Seventh Five-Year Plan Huainan will be producing much more than its current 10 million tons a year.

With ample water resources and convenient transportation, Huainan is an ideal place to develop pit-mouth power plants. To this end, during the Sixth Five-Year Plan, the State provided funds for the construction of two key projects--the 1.2 million-kilowatt Luohe plant and the 2.4 million-kilowatt Pingyu plant. Begun at the end of 1982, the first stage of the Luohe plant, which called for the installation of two 300,000-kilowatt generators, joined the grid in mid-October 1986. The electricity is transmitted via 500,000KV high-tension power lines into the East China Grid. Preparation work for the second stage of Luohe is now preceeding apace. Ground was broken on the Pingyu plant in September 1984. Pingyu is the largest pit-mouth power plant now under construction in China. According to plans, the first stage of construction entails the installation of two 600,000-kilowatt generators and should be completed during the Seventh Five-Year Plan. At that time, the total installed capacity of all the thermal power plants in Huainan will be 2.4 million kilowatts capable of generating 16 billion kilowatt-hours of electricity a year, or four times that of 1985.

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CSO: 4013/36

## HEILONGJIANG EXPERIMENTAL GANGUE PLANT SHOWING PROMISE

OW111414 Beijing XINHUA in English 1317 GMT 11 Nov 86

[Excerpt] Harbin, 11 Nov (XINHUA)--Trial use of gangue rock, a waste produce of coal mining, to generate electricity now promises success in northeast China's Heilongjiang Province.

An experimental thermopower plant fueled by gangue rock has produced more than 160 million kWh of electricity since February when its two generating units began operating normally after renovation, a local official said today.

The Didao plant, the largest of its kind in China, is part of the Jixi coal mining administration.

At present, an estimated 1 billion tons of gangue rock are stockpiled at coal mines throughout China. "The rock occupies space and their spontaneous combustion pollutes the air," the official said. "The rocks can burn, but they produce only about one-third as much heat as coal," the official added.

The two generating units at the Didao plant were put into operation in 1977. "But the units had never run properly until engineers renovated some key parts of the equipment earlier this year," the officials stated.

China's coal mines discharge a daily average of 10 million tons of gangue. "That means 8 billion more kWh of electricity could be produced with that amount of gangue used as fuel," the official said.

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CSO: 4010/19

THERMAL POWER

## DIANDONG PLANT NOW FULLY OPERATIONAL

Nanning GUANGXI RIBAO in Chinese 25 Oct 86 p 1

[Excerpts] On 23 October, the 25,000-kilowatt number four unit of the Diandong power plant--located on the banks of the You Jing--was completed, giving new impetus to the economic development of the area.

Located next to the Diandong coal mine, the Diandong power plant is the second pit-mouth power plant in Guangxi. The original installation had two 12,000-kilowatt units. In 1983 one 25,000-kilowatt unit was added, and last year work was started on the fourth unit. At present all four units are in operation, so the total capacity comes to 74,000 kilowatts, making it one of the mainstays of the Guangxi power network.

Unit four of the Diandong power plant represents one of the key projects of the nationwide plan to put 5 million kilowatts of power generation into operation this year. The construction was undertaken by the Guangxi Thermal Power Construction Company and the Thermal Power Installation Company. With the support of experienced master workers they formed a youth shock brigade to take part in the campaign launched by the Communist Youth League of China for "youths to contribute to the border areas." Consequently, they finished a month's work in only 13 days, without sacrificing quality.

After the entire Diandong power plant is in operation it will help alleviate the tight electric power situation in our area that we experience during the dry season when hydroelectric power generation is down, maintaining the stable operation of the Guangxi power netowrk.

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## BRIEFS

210MW GENERATORS FROM USSR--XINHUASHE, Beijing, 24 Oct 86--A contract with the Soviet Union to import 10 210,000-kilowatt power generators was signed this afternoon at the Greal Hall of the People. The contract stipulates that the 10 generators would be imported from 1987 to 1990 and would be installed at Tanze in Shanxi, Huangdao in Shandong, and Mudanjiang and Shuangyashan in Heilongjiang. Vice Minister of the State Council Li Peng chaired the signing ceremony. General Manager of the China National Technical Import Corporation Xu Deen and General Manager of the China Water and Power International Company Zhu Jingde signed the contract for the Chinese side while [Vladimir] Pavlov, general director of the Soviet Power Machinery Export Company [Energomashexport], signed for the Soviet side. Before the signing ceremony, Li Peng had met with Soviet Ambassador Shcherbakov, Pavlov, and other Soviet guests. Li Peng stated: "The signing of this agreement is useful for both sides. The contract could promote trade between China and the Soviet Union." [Text] [Nanchang JIANGXI RIBAO in Chinese 25 Oct 86 p 3] /6091

POWER EQUIPMENT FROM FRANCE--An agreement to import equipment for two 330-megawatt power plants from the Alsthon Company of France was signed in Beijing on 1 December. Vice Premier Li Peng attended the signing ceremony and met with the French guests. Representatives from both sides who signed the agreement included Xu Deen, executive director of the China National Technical Import Corporation, and the executive director of the French Alsthon Company. [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 4 Dec 86 p 3] /6091

LIANGZI HE PLANT EXPANSION--The project to expand the Liangzi He power plant was recently formally started. The project is being financed jointly by the Daqing Petroleum Management Bureau and the Heilongjiang Bureau of Electric Power Industry. The Liangzi He power plant is located in the southern foothills of the Lesser Xing'an range and the lower reaches of the Tangwang He. To the east is the coal town of Hegang and the industrial city of Jiamusi. Water resources are abundant, and transportation convenient. The installed capacity of the first phase of the power plant, which has been in operation many years, is 100,000 kW. The installed capacity of the second expansion phase will also be 100,000 kW, and it is scheduled to go into operation in 1988. At present some of the foundations for major plant buildings, the foundation for a 150-meter stack, the foundation for a chemical water treatment facility, and some other production-related projects have already been completed. [Text] [Harbin HEILONGJIANG RIBAO in Chinese 22 Sep 86 p 1] /6091

XIAOLONGTAN NO 2 UNIT OPERATIONAL--At 0215 hours on the 7th of November, the No 2 generator of the Xiaolongtan power plant--a major energy construction project in Yunnan Province--became operational. This 100MW unit is the second to go on stream at the plant, the first generator having joined the grid in December 1985, and is the largest capacity generator in a thermal power plant in the province. The power produced by this unit will greatly help meet the demand for electricity in the industrial and agricultural sectors. [Text] [Kunming YUNNAN RIBAO in Chinese 8 Nov 86 p 1] /6091

GUIXI PLANT ADDS UNIT--The No 3 generator at the Guixi power plant is the fifth 125,000-kilowatt unit in Jiangxi Province. Installation of this unit began on 21 May of this year and became operational on 27 October--ahead of schedule. The unit will greatly ease the shortage of electric power in the province. [Text] [Nanchang JIANGXI RIBAO in Chinese 29 Oct 86 p 1] /6091

HESHAN ADDS FINAL UNIT--After running smoothly for a trial period of 72 hours, the eighth and final generator of the Heshan thermal power plant has become fully operational. Concurrently, major projects associated with the power plant, such as its 400,000-ton coal reserve project, have also been completed. The plant has a total installed capacity of 495,000 kilowatts and is now the largest in the autonomous region. The No. 8 generator has a capacity of 100,000 kilowatts. The plant was begun in 1967 and the first stage of construction called for the installation of three 25,000-kilowatt generators. Following that, four high-temperature, high-pressure units were added. As of the end of September 1986, the plant had provided some 11 billion kilowatt-hours of electricity to the region. [Summary] [Nanning GUANGXI RIBAO in Chinese 29 Oct 86 p 1] /12223

CSO: 4013/36

## DESPITE FALLING PRICES, GREATER OUTPUT URGED

OW131118 Beijing XINHUA in English 1052 GMT 13 Dec 86

[Text] Beijing, 13 Dec (XINHUA)--A senior official today called for continued increases in China's coal output although the traditional shortages have significantly alleviated.

The country produced 785 tons of coal in the first 11 months of [1986], causing coal prices to drop, Coal Industry Minister Yu Hongen told XINHUA.

Nevertheless, China still needs more coal, he said, noting that coal accounts for 72 percent of the non-renewable energy it consumes, and that it needs to export more coal for foreign exchange.

He called on miners to work harder still to ensure an annual increase of 40 million tons during the 1986-90 period.

The ministry also called for work to attract more foreign investment to upgrade the existing mines to increase the output of high-quality coal for export.

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CSO: 4010/20

## COAL INDUSTRY TO BOOST PRODUCTION, EXPORTS

HK270610 Beijing CHINA DAILY in English 27 Nov 86 p 1

[Article by staff reporter Guo Zhongshi]

[Text] China's coal industry, aiming for higher efficiency to fuel the country's modernization drive, is expected to turn out 870 million tons of coal this year, a senior official of the Ministry of Coal Industry said yesterday.

The yield is being accompanied by a soaring export volume which the ministry anticipates will reach 10 million tons this year, CHINA DAILY learned from a working conference on the coal industry being held in Beijing.

The total output of coal last year was 850 million tons and exports were 7.5 million tons, 33 percent lower than this year's.

The industry has also made marked progress this year in terms of safety, efficiency, and technical achievements, sharply cutting accidents that often occur due to underground ventilation, roof falls and transport and reducing the death rate to the lowest record of mining deaths since the founding of the People's Republic in 1959, said Hu Fuguo, vice-minister of the Ministry of Coal Industry.

Looking back, the vice-minister said, "We have basically fulfilled all the tasks set at the beginning of the year, cleared the hurdles on our way to modernized mining, stepped up research work and strengthened mining machinery manufacturing capability."

So far, China has exported 8.22 million tons of coal to Japan, the Philippines, Denmark, Hong Kong and other areas.

An official of the ministry said the amount of coal exported was minor compared with the country's total output.

The official said his ministry would make efforts to improve coal transportation facilities, upgrade quality and increase total exports to 30 million tons by 1990.

The local small and medium-sized coal mines, which are mostly operated by collectives or individuals, have produced more than half of this year's total yield.

Hu said the development of local coal mines, of which there are already more than 65,000 throughout the country, helped to ease the supply shortage, improve distribution and promote rural prosperity, especially in economically underdeveloped areas.

The State is putting more money into the coal industry next year, aiming for an output of 900 million tons, and into the construction of more large and medium-sized projects with better equipment and transportation facilities.

In 1986, 47 percent of coal mining in major pits will be mechanized and by 1990 the figure is expected to reach 56 percent, Hu said.

The ministry will see to it next year that safety levels are higher, with stricter measures to prevent fires, gas explosions and other serious accidents.

Quality standards will be set nationwide, coupled with a safety responsibility system that links workers' performance to their income, he said.

Coal processing will be localized and the ministry will further reform the present management system to help avoid economic losses.

Technological markets, to be held next year, will cover bidding, technical consultancy, technical services and contracts, information flow and the exchange of trained personnel, Hu said.

CSO: 4010/15

## MINES GEAR UP TO MEET EXPECTED EXPORT DEMANDS

OW130146 Beijing XINHUA in English 0106 GMT 13 Dec 86

[Text] Beijing, 13 Dec (XINHUA)--China's coal industry has achieved new developments in diversification, modernization and opening up overseas markets.

In line with the development of the commodity economy, coal mines have expanded coal-dressing, coal-washing and multi-purpose utilization of coal, the overseas edition of the PEOPLE'S DAILY reported yesterday. Sales of raw coal from China's major coal producers have dropped to 15 percent of the total volume, a 37 percent decrease over last year, according to the paper.

Dressed coal output is expected to increase to 59 percent this year from 31 percent last year. Production of brick and cement made of coal mining waste gangue has achieved good economic results and exports are expected to earn $5.5 million U.S. in foreign exchanges this year.

China's coal mines have increased output by adding more manpower. The Coal Industry Ministry has made great efforts to upgrade technology and equipment, introduce scientific management and improve its staff's professional ability, the paper said.

A total of 77 coal mines have been designated for modernization under a pilot program in the Seventh Five-Year Plan period (1986-1990), the paper said.

More markets have been opened up overseas in the past 2 years. The state has listed coal as a major export item to earn foreign exchange. Coal exports are expected to top 9.8 million tons this year, compared with last year's 7 million tons. Exports next year are expected to reach 16 million tons.

Coal produced by 20 mines has been exported to 15 countries and regions, including Japan, Belgium, and Hong Kong.

A total of $2 billion U.S. in foreign investment will be used to construct new mines, mine-connected power stations, and railways in the coal-producing areas, the paper said.

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CSO: 4010/20

## DESPITE CLAIMS OF SUCCESS, INDUSTRY ONLY MEETING MINIMAL REQUIREMENTS

Beijing ZHONGGUO MEITAN BAO in Chinese 21 May 86 pp 1, 2

[Article by reporter Gu Dalin [7357 1129 7207]: "Does China Really Have Too Much Coal? -- A Survey of Coal Markets, Shipping, and Sales"]

[Text] Statistics from the recent formal annual report of the Ministry of Coal Industry that were examined and approved by the State Statistical Bureau indicate that raw coal output in China during 1985 was 872.28 million tons, an increase of 83.05 million tons over 1984 and a net increase of 251 million tons over 1981. This was the fourth consecutive year of substantial growth in output in China's coal mines. Moreover, stockpiles at mines have continued to grow and state-run mines alone has stockpiles of more than 30 million tons at the end of 1985.

Do we have too much coal now? Many comrades both inside and outside the industry have been asking this question. What actually is the coal supply and demand situation? How can production best be arranged? With these questions in mind, this reporter visited the relevant departments and surveyed the rather sensitive market in the Jiangsu-Shanghai region.

I. From a Coal Shortage Emergency to a Bulging Stocks Emergency, Supplies Actually have Eased Up

The Main aspects to examine are:

1. There has been an obvious decrease in the number of emergency telegrams concerning coal shortages arriving at the Ministry of Coal Industry since the second half of 1984 and there basically were none during 1985. Just the opposite, there have been increases in the number of telephone calls and telegrams from coal mines about excessive reserves that are putting pressure on hauling and shipping and from users with full storehouses who request temporary halts in coal allocations.

Jiangsu and Liaoning, two major coal-short provinces, have shifted from having to send people out to buy coal to sitting and waiting for on-site deliveries. They have gone from purchasing regardless of price to prices based on quality and are becoming increasingly concerned with the quality of coal. Several years ago, Sichuan was a net importer of coal. Over the past 2 years, however, several million tons of east Sichuan coal have been floated down the rivers. It is being sold in southern Jiangsu at 70 to 85 yuan per ton, and has become a new competitive force.

In Shanxi Province, which for years has had rather large coal reserves, stocks of coal have risen to 43 million tons. In coal mines in Hunan and Guangdong provinces, which have had only small coal reserves in the past, overstocks have appeared and some mines have been forced to reduce output or even shut down.

During the National Coal Ordering Conference held during the winter of 1985, Dayan, Shulan, Zixing and other unified distribution mines had problems in selling lignite and coal with a high ash content and were forced to send out people to look for orders.

The coal market no longer is an independently managed enterprise. Some coal mines are selling their own coal and collectives as well as individual households that ship and sell coal have appeared. Market prices are set according to quality and competition is fierce. Market prices for coal in Shanghai and Jiangsu have dropped by about 10 yuan from the average price during 1984-85.

All situations indicate that the coal supply and demand situation has moderated, which is something that has not been seen in decades. This is the result of the relaxation of state control over the development of small coal mines and implementation of comprehensive contractual responsibility over unified distribution mines. Moderation of supply and demand for coal, China's primary energy resource, has created an even better economic environment for reforms throughout China. Moreover, it has eliminated the passive situation of the past in which the coal industry was concerned only with output by placing it on the path of benign cycles and a focus on quality, and it has laid a good foundation for modernized construction of the coal industry. The moderation also has created a new situation for users by means of prices based on quality. This has caused the coal industry to improve coal quality, develop processing and improve management and to make a greater shift into the orbit of improving economic results. This sort of new situation should be a matter of rejoicing.

II. National Coal Stockpiles Are Not Excessive and the Moderation Is Rather Limited

According to materials from the National Fuel Work Conference that concluded not long ago, total national coal stockpiles at the end of 1985 (including coal stored at mines) amounted to 137 million tons, an amount that can be turned around in 57 days. Moreover, this is not in excess of rational stockpiles for a 2-month period and is even a little low. This definitely is not a surplus of coal.

The rather sizeable stockpiles at present are subject to shipping restrictions. This is an abnormal factor that has had serious effects on coal production. Moreover, supplies in coal-short regions remain limited. On the surface, it would appear that supplies are plentiful in the Jiangsu-Shanghai region. The rate of coal consumption in this region has been rather high in recent years however, and coal storage sites have not increased. Shanghai has about a 2-week supply while those in Jiangsu are less than 40 days, and they are crying about "swelling warehouses."

Several typhoons occurred during July, August, and September 1985 that affected the shipment of coal to Shanghai. Supplies in Shanghai have been plummeting to the extent that they will have to ask for emergency help. As a result, supplies in coal-short regions remain weak and cannot meet demand.

A look at supplies also indicates that there are considerable amounts of substandard coal. Substandard coal accounted for 58 percent of Jiangsu's supply at the end of 1985 and more than one-third of Liaoning's. The large amount of substandard coal means that deductions must be made from effective supplies. As a result, supplies cannot be considered excessive.

Market prices indicate that although there has been a slight drop from the high prices of 2 years ago, a substantial price differential persists between the unified distribution price and the market price in coal-short regions. In Shanghai, for example, the average difference per ton is 40.5 yuan. The situation in southern Jiangsu, Zhejiang, and Liaoning is basically the same. Generally speaking, prices are capable of reflecting the relationship between supply and demand. Although prices in China assume rather complex forms and include many less-than-rational factors, the wide gap between these two types of coal prices indicates that the present moderation of coal supplies remains only a relative one in terms of the shortage situation over the past several years and in terms of the original scope of supply. A large number of consumers outside of plans like civilian and local industries and township and town enterprises, however, are far from able to satisfy their needs. The degree of moderation is very limited.

Especially noteworthy is that an examination of arrangements in the Seventh Five-Year Plan shows that there still are shortages in coal supplies. This is especially true of the electric power industry.

## III. Rapid Growth in Coal Used To Generate Electricity Now Accounts for One-Half of Coal Plan Increases

The energy resource shortage is a major factor which restricts development of the national economy at the present time and which is manifested now mainly in a shortage of electric power. Statistics provided by the Sichuan Provincial Planning Commission show that power shorages in some regions have forced some to "shut down 3 days to guarantee 4" and "shut down 4 days to guarantee 3" each week. Although the East China Grid provided increased supplies of electricity to Shanghai during the first 2 months of 1986, the Baogang [steel mill], the Comprehensive Petrochemical Plant and other large users of electricity increased their electricity consumption by 94 percent and there actually has been a 3.4 percent drop in electricity consumption in other units that use power. In southern Jiangsu, where township and town enterprises have developed quickly, power shortages have caused many factories to install backup diesel generators. They generate power on the basis of negotiated prices for fuel and the costs per kWh exceed 0.40 yuan.

To deal with the power shortage, the state has accelerated electric power construction. According to the most recent statistics from the Ministry of Water Resources and Electric Power for 28 March, the generator capacity added throughout China during 1985 made it the highest year since the nation was founded. Thermal power accounted for 5,870,700 kW of the total. If we calculate on the basis of newly added generator capacity, additional supplies of about 20 million tons of coal will be necessary during 1986. Consideration must be given to abandoning a small number of old low-efficiency generators and some new generators will not be able to operate at full loads for a period. Even so, an additional 15 million-plus tons of supplies would be needed during 1986.

According to arrangements for electric power construction during the Seventh Five-Year Plan, the amount of newly added thermal power generator capacity will exceed 5 million kW each year over the next 5 years. The annual rate of growth in coal consumed to produce electricity will be 15 to 20 million tons. If we calculate according to the lower limit, the one-fifth of China's coal consumption that is used to generate electricity will account for one-half of planned growth in coal during the Seventh Five-Year Plan.

Demand also is growing quickly for coal used for household purposes (22 percent of total consumption at present). There was a net increase of more than 63 million tons between 1979 and 1984. The populations of large and medium-sized cities continue to grow and the populations of small towns are growing even faster, so demand for coal for household use is burgeoning. If we calculate according to the average rate of growth over the past few years, this would require more than 12 million tons of additional supplies a year.

Also deserving of our attention is coal used for coking (8 percent of total consumption at present). There will be a forecasted increase of 25 million tons of refined coking coal in the metallurgical system alone during the Seventh Five-Year Plan. Predicted coke consumption for founding, the chemical industry and other uses will increase by 10 million tons. This will require an average of an additional 7 million tons of refined coal supplies each year.

Thermal power, coking and household uses, the three main items outlined above, now account for only about one-half of total coal consumption in China, and require a minimum yearly additional demand of 34 million tons. How much, then, is demand in those areas that account for the other half of total consumption? If we calculate on the basis of the 3.4 percent index of average yearly growth in energy resources as specified in the Seventh Five-Year Plan, they would require 15 million tons of additional coal supplies in a year. Added to the 34 million tons mentioned above, the minimum increase in demand would be 49 million tons.

The above calculations are based on a minimum growth in demand. In comparison, the [figures] derived by the Ministry of Coal Industry are higher than state plans. Arrangements to produce an additional 40 million tons each year obviously are minimum goals and provide for some flexibility. For this reason, we should guarantee their completion and strive to exceed quotas.

12539/12624
CSO: 4013/154

COAL

ARMAND HAMMER VISITS PINGSHUO, SAID ENCOURAGED BY PROGRESS

HK101037 Beijing RENMIN RIBAO in Chinese 6 Dec 86 p 2

[Feature by staff reporter Liu Xieyang (0491 3610 7122): "Armand Hammer in Pingshuo"]

[Text] On 2 December, 88-year-old Dr Armand Hammer, chairman of the board of the U.S. Occidental Oil Corp. and world famous entrepreneur, together with a group of foreign entrepreneurs, bankers, and foreign and Chinese reporters, arrived at the Pingshuo open-cut coal mine in Shanxi, on a special flight from Beijing.

This was Hammer's second visit to the coal mine. Situated on the border of Pinglu and Shuo counties in Yanbei Prefecture, Shanxi Province, this large coal mine has deposits of 450 million tons of coal. It is the largest open-cut coal mine jointly run by China and the United States and is also the first energy project to use a foreign loan with limited right of claim. For this project, Hammer has spent much painstaking effort traveling between the two Pacific coasts. When the construction of this project started in July last year, Hammer and Vice Premier Li Peng attended the opening ceremony. Now the construction has been under way for over a year. How is it progressing? Can it be completed and put into operation as scheduled? This is what people are concerned about.

As soon as Hammer left the plane, he went straight to the construction site by car, where he was attracted to the busy scenes of construction. The site was a desolate area something over a year ago. But now tall buildings have risen up and railroads and highways have been built. Large loading machines and stripping equipment rumble over the construction site...

A person responsible for the project told Hammer: The work of changing the course of the 25-kilometer-long Qili He has been finished and the ex tion projects for four of the six roads to the coal mine have been complete, while the construction of the coal mine itself is being carried out at a faster rate. The construction of the dressing plant and the production line will be completed in the first half of next year. At present, the coal mine project has been half completed and it has been estimated that it will go into production in July next year and will produce 50,000 tons of coal per day by

the end of September [1987], with an annual output of 15 million tons after the completion of the project.

Hearing this, Hammer said happily: It is beyond my expectations that the changes have been so fast. This iron-clad fact proves that this cooperation project between China and the United States is successful. Some people cast doubt in the past. They seem to have underestimated.

A foreign reporter asked Hammer: "Why do you have such confidence in this project?" Laughing, Hammer replied: "The hope of the world lies in China. I have confidence in the leadership and current policies of China, which is making progress every day under the leadership of Deng Xiaoping."

As world coal prices keep falling, some people are worried that this coal mine will have problems in finding outlets for its coal. On this worry, Hammer quipped: "This issue should be viewed from the long term. Coal prices are falling, but this is temporary. The United States does not have ample oil reserves now; they will not last many years. The United States will have to import coal. Therefore I am optimistic about the future."

Talking cheerfully and humorously, Hammer did not in the least seem to be an old man of almost 90. He said that he will come to Pingshuo again next year to celebrate with everyone there the putting into production of the coal mine.

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CSO: 4013/30

## SLURRY TECHNOLOGY SAID TO BE AT INTERNATIONAL LEVELS

OW041313 Beijing XINHUA in English 1045 GMT 4 Dec 86

[Text] Beijing, 4 Dec (XINHUA)--China has reached international levels in the techniques of preparing and burning coal slurry, according to the Ministry of Coal Industry.

"Research and development of the two techniques have now evolved from laboratories to the field tests," said Hao Fengyin, deputy general engineer of the ministry, who is in charge of the coal slurry research program. Coal slurry is a mixture of coal, water, and additives.

A successful experiment has been conducted in a paper mill recently on burning coal slurry in an industrial boiler with a capacity of 60 tons of steam per hour, according to associate professor Xie Minghu, who is in charge of combustion technology of coal slurry.

The boiler, which burned coal slurry from an experimental production plant in northeast China, has successfully powered a 1,500-kW generator, Xie told XINHUA.

Coal slurry is an ideal oil-replacing fuel that creates little pollution, said professor Zhang Rongzeng, who is in charge of preparing coal slurry. It can be pumped through pipelines, stored and burned in the same manner as oil.

Professor Zhang said, coal slurry boasts a wide prospect for industrial application as it can burn in common industrial boilers and furnaces. It gives off only half as much heat as oil.

He said, China has a great potential in the industrial production of coal slurry as it boasts rich and assorted coal reserves scattered across the country.

According to the Ministry of Coal Industry, the project entitled research and development on the technology of coal slurry preparation and combustion was approved as one of the key projects in the Sixth Five-Year Plan in 1983.

Two coal slurry experimental plants were built in Fushun, Liaoning Province, and Zaozhuang, Shandong Province with an annual designed production capacity of 90,000 tons and 60,000 tons respectively, according to the ministry.

The government has listed the slurry project high on its priority list covering the next 5 years. It is hoped this will speed its production as a widely-used source of energy for industry, deputy general engineer Hao Fengyin told XINHUA.

He noted that China is going to expand the experimental application of coal slurry into power stations, various industrial boilers, and furnaces.

China is also looking for international cooperation and help in its research and development on the technology of coal slurry, he said.

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CSO: 4010/21

## COAL QUALITY INSPECTION CENTER ESTABLISHED

OW231818 Beijing XINHUA in English 1513 GMT 23 Dec 86

[Text] Beijing, 23 December (XINHUA)--A coal quality inspection center has been set up and it has started to work, the Ministry of Coal Industry announced here today.

The center, founded jointly by the State Bureau of Standardization and the Ministry of Coal Industry, is authorized by the state to inspect the quality of coal. Its inspecting techniques have reached the world standards of the 80's.

The Center takes charge of the inspection of coal for domestic industrial, agricultural and civil use as well as for export. The coal that is not up to the standards will not be shipped for export.

China's coal exports have been increasing in recent years. The country is expected to export 10 million tons this year and a total of 100 million tons from 1986 to 1990.

The center will inspect all coal for export or import to guarantee the quality, an official from the Ministry of Coal Industry stated.

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CSO: 4010/23

## LIAONING'S FIRST LONG-FLAME COAL GAS FACILITY

Shenyang LIAONING RIBAO in Chinese 2 Oct 86 p 1

[Article by staff reporter Jin Hongcai [7246 3163 2088]: "China's First Long-Flame Coal Gas Plant Being Built in Fuxin; Coal Gas Can Supply 57,000 Households"]

[Text] Work has already begun in Fuxin on China's first coal gas producing plant using long-flame coal and on a thermal power plant. On the eve of 1 October [1986], a busy scene of intense construction was under way: a coal-receiving pit capable of storing six hundred tons of coal for the gas source plant of the main coal gas project was being dug, the foundation for a 5000-cubic-meter gas storage tank was already completed and a water tank was being carried out at the thermal power plant work site; and, truck cranes were laying a pipeline in the deep ditches dug along the sides of several roads in the city proper.

Fuxin is one of the major long-flame coal producing areas in China. In the past, it was thought that coal gas could not be manufactured from long-flame coal and that it could only act as a boiler fuel. Because of this, although Fuxin is a city which burns coal for electricity, for more than 30 years since the founding of the country, the city residents were only able to burn raw coal or pcar, wasting energy resources and polluting the environment. With state approval, the major equipment for the coal gas plant on which construction was begun this year in Fuxin is imported from abroad. This is China's first gas-making installation using long-flame coal as the raw material. The daily production of coal gas will be 240,000 cubic meters and can supply a total of 57,000 of the city's households, or 77 percent of the urban population. After being built and placed in operation, 147,500 tons of fuel coal can be saved, the amount of smoke and ash discharged will be reduced more than 1.22 million tons annually, and carbon dioxide will be reduced 2,013 tons. The first phase of the project will be finished and put into production in October 1988. The construction of this coal gas project opens up a new road for coal gasification for small and medium-sized cities throughout the country and will enable Fuxin to become a manufacturing center for coal gas boiler equipment for long-flame coal throughout China, a testing center of long-flame coal for gas-making, and a technical training center.

The total installed capacity of Fuxin's thermal power plant on which construction was begun in August of this year is 18,000 kilowatts. The annual generation of electricity is 90.34 million kWh, and the total annual heat supply is 510 billion Calories. It an area of 710,000 square meters. After completion, 74 boiler units used for heating will be shut down, saving more than 80,000 tons of coal every year.

13310/12951
CSO: 4013/0016

## STATE TO SET UP CONSORTIUM TO DEVELOP SHAANXI FIELD

HK281438 Xi'an Shaanxi Provincial Service in Mandarin 0030 GMT 28 Nov 86

[Text] The state has decided to organize a consortium with the (Huamen Jingmei) Co. as the foundation to be responsible in a unified way for the development of Shenfu coal field. While inspecting the Shenfu field this year, Premier Zhao Ziyang pointed out: It is necessary to use the best and most flexible system to develop Shenfu coal field. This new system will break through our country's old convention of each going his own way in coal mining, electric power generation, and road repair and of unified coordination by the State Planning Commission in the course of building a mine in the past and thoroughly destroy the shackles by departments and regions at all levels.

The state will organize a consortium with (Huamen Jingmei) Co. as the foundation to be responsible in a unified way for the development of the whole field. This consortium will implement a stock company management system. Departments and units of the central authorities and localities, enterprises, collectives, and individuals can buy shares. All shareholders can enjoy dividends according to their shares.

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CSO: 4013/30

# STUDY, UTILIZATION OF LOW-ASH COAL RESOURCES IN CHINA

Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] in Chinese No 9, Sep 86 pp 40-42

[Article by Dai Hewu [2071 0735 2976], director, Beijing Coal Chemistry Institute of the Coal Sciences Research Institute and deputy chairman of the Professional Committee on Coal Chemistry of the China Coal Society]

[Text] Coal is a major energy resource in China. The output of China's coal is increasing at a fast pace and coal quality is receiving more and more attention. Along with the ease of mining superior quality coal being reduced day by day, the quality of raw coal has gone bad, and increases in the level of coal mining mechanization have increased raw coal impurities. In China in 1965 and 1977, the coal ash mixed in with the coal mine commodity was 19.56 percent and 23.51 percent. By means of coal quality management and technological innovation, the coal ash content in the commodity in 1983 and 1984 dropped to 20.31 percent and 20.05 percent.

In line with the development of the national economy in China, all trades and professions urgently require coal quality to be increased further to increase coal exports, raise product quality and economic benefits, save energy resources and protect the environment. The average ash content in China's coking fine coals has, for a long time, been at 10.3 percent, but for the technologically advanced countries in the world it is mostly at 6 to 8 percent. The very large 4,463 $m^3$ boiler at the Baoshan Iron and Steel Complex and large steel mills require the ash content of metallurgical coke to be less than 13 percent and require that the coal ash content of the coking to be 10 percent or less. This will accelerate the carrying out of overall planning and study that China should do for the production, distribution, allocation, and transportation, utilization and pricing policies and such of superior quality coking coal so that they will be suited to the future development of the metallurgical industry. Aside from this, casting coke, coal slurry, carbon materials, blast [furnace] fuels, and so on all require the use of low-ash coal resources. The contradiction between the margin of coal quality increases and the requirements of the coal-using departments is one needing systematic study and conscientious resolution. For this reason, [we must] get a clear understanding of the distribution and special characteristics of China's low-ash coal resources, study different regions to increase the quality and quantity of low-ash coal, and formulate scientific utilization

policies and distribution principles to enable China's coal resources to enjoy even more effective utilization. This is an important task of very immediate significance.

## I. The Division of Low-Ash Coal Resources

The amount of ash content determines the quality and economic value of coal. Under normal conditions, the ash content of coal is a useless impurity and increasing the ash content brings about unfavorable factors to all kinds of uses for coal. Generally, coal with an ash content less than 15 percent is called low-ash coal. In line with several departments having even stricter requirements for coal ash content, raw coal with an ash content lower than 8 percent is called very low-ash coal. Presently, departments which produce high-quality products and materials hope that the production and supply of very low-ash coal will be expanded. The ash content of raw coal produced by several mines of the Datong Mining Bureau is lower than 8 percent. Speaking for the whole country, the proportion of coal resources where the ash content of the raw coal is lower than 8 percent is certainly not high. Much necessary attention ought to be paid to the development and utilization of these coal resources.

Low-ash coal resources endowed in the form of large coal fields are few in number whereas there are many in small and medium-sized coal accumulating basins. Even if the ash content of raw coal in a coal mine or seam of a coal field are not the same, only one or a few mining seams of some mines are low-ash coal and very low-ash coal is even rarer. If a coal mine's production system or preparation plant does not have separate mining, storage, and preparation systems and mixes the low-ash coal with the average coal so that it cannot be used as a superior quality coal, this is a very big waste.

## II. The Distribution and Characteristics of Low-Ash Coal Resources

According to coal data and studies of the exploration and exploitation of coal fields in regard to coal quality, several characteristics on the accumulation and distribution of China's low-ash coal resources have been discovered.

The distribution of the low-ash coal resources is very uneven and mainly in North China and in the Northwest. Although there is the Fushun coal in the Northeast which has long been producing coking blended coal where the fine coal ash content is 5 to 6 percent, it is used to supply the Anshan Iron and Steel Complex and its own steel plant. In the near future, the low-ash, strongly cohesive coking coal produced from the Qitaihe Coal Mine in Heilongjiang and the Hongyang Mining District in Liaoning will be exploited; however, there aren't many reserves of this coal resource in the northeast region. In South China and in the southwest region there are also a few small coal-producing areas, such as Niumasi, Jinzhushan, and other mines producing low-ash coal. However, the reserves are very small. In East China, except for the gradually decreasing output of the Guanqiao Mining District of Zaozhuang, the Yanzhou Mining District going into production in the near future has abundant low-ash coal resources. Datong in North China is the present major producing area of low-ash coal in China. The superior-quality

anthracite coal of the Rujigou mine in the Northwest is renowned at home and abroad. Aside from these, several very large coal fields have been discovered in succession in North China and in the Northwest, such as Shenmu, Dongsheng, Lingwu, and other abundantly endowed low-ash coal resources. Moreover, along with the continual exploration for new coal fields in the Northwest, several more low-ash coal resources may be found one after another, demonstrating the fine exploitation prospects.

Low-ash coal resources are mainly distributed in the Early and Middle Jurassic coal-forming periods and coal-accumulating belts. Even though there have been low-ash coal resources discovered in each of the coal-forming periods in China, including the Tertiary and Carboniferous-Permian Periods, no matter whether one speaks of the number of coal fields, the area of coal accumulation, or the amount of accumulated coal, the major period of coal accumulation in China was in the Early and Middle Jurassic, especially the low-ash coal resources which are in North China and in the Northwest. The upper portion of the Datong Coal Field is Early and Middle Jurassic and the lower portion is Carboniferous-Permian; the upper portion is low-sulfur, low-ash coal and the lower portion is medium sulfur and high-ash coal. A similar situation also exists for Jing-Xi coal, that is, there are differences in the coal quality of the Jurassic-formed coal in different mines. The optimum quality is the low-ash, low-sulfur coal produced at the Changgouyu Coal Mine. Not only is the blended coal and coke used to supply the Beijing Coking Plant as a thinning agent and is blasted in the Capital Steel Plant's blast furnace, this type of low-sulfur, low-ash coal where the sulfur content is lower than 0.2 percent also has special usages.

The varieties of low-ash coal are mainly noncoking coal and, rather rarely, strongly cohesive coal. They are mainly noncohesive coal, weakly-cohesive coal, and gas coal. For example, Datong, Fushun, Yanzhou, Guanqiao, Aganzhen, Shenmu, Dongsheng, and Lingwu are of this type. Secondary [varieties] are anthracite coals and other highly metamorphized coals, such as Rujingou, Jing-Xi, Jinzhushan, Xinmi, and others. Moderately metamorphized coking coals, especially strongly cohesive, low-sulfur coal, are rather rare, e.g., Niumasi, Qitaihe, Xiqu, Linhuan, and other mining districts. These resources being few in number, high in value, and having certain other characteristics for which other coals cannot be substituted, China must fully treasure its utilization, protect the resources, regulate its exploitation, and make reasonable use of it.

## III. The Processing and Utilization of Low-Sulfur Coal

### 1. Producing High-Quality Metallurgical Coke

The ash content of China's metallurgical coke is 2 to 4 percent higher than that abroad and priority must be assured that low-ash coking coal be used in coke and that low-ash, weakly congealed coal be used more in mixed coal. At the beginning of the sixties, Capital Steel Plant used Datong's Mawushan coal (the fine coal ash content was less than 4.5 percent), it comprised 32.6 percent of the coking mixture, and when Datong's Puhuagong coal was chosen to be used (the fine coal ash content is 6 percent), 23 to 25 percent could

be used in the coking mixture. As for the strongly congealed coal of North China, each key steelworks and local coking plant eagerly hope to use more of Datong's low-ash coal in the blended coal so that the coking boiler expansion pressure can be reduced, gas and chemical products can be increased, and higher economic benefits can be obtained.

2. Developing Superior-Quality Casting Coke

In order to increase casting quality, decrease reject rate and raw materials consumption, and suit export casting coke requirements, domestic scientific research units and concerned production and application departments in the past few years have developed and selected casting coke production technologies and bases aimed at the coal resource characteristics of the different regions and have already obtained gratifying results. In order for special-grade casting coke to satisfy several thin-wall, precision and special requirements, it is required that the ash-content be smaller than 8 percent and the sulfur-content be less than 0.6 percent, that is, super-low-ash coal must be used more as a raw material. A large, special-grade superior-quality casting coke production base is to be built in Shanxi and selecting a 3.5 to 4.6 percent ash, washed fine Datong coal is being considered. It will comprise 35 to 45 percent of the major blend coal alternative.

3. Preparing Coal-Water Slurry Fuel

Coal-water slurry is now on the rise as an oil-substitute fuel. The ideal ash content for the coal used in coal-water slurry (composed of about 70 percent coal, 30 percent water, and 1 percent additives) is best under 3 to 5 percent. There is also to be a suitable proportion of different sized particles. Coal-water slurry used in oil-burning boilers still have several technical problems needing resolution, such as coal-burning apparati, ash extraction, dust extraction, wear, corrosion, and so on. However, whether the prospects for using coal-water slurry are good or bad is determined by the comparative price of oil and coal. Two tons of coal-water slurry can replace 1 ton of oil, and, by selecting coal sources which are abundant in resource, low in cost, high in rate of recovery, and easy to make slurry from, can coal-water slurry then have an even greater competitive force. The low-ash coal needed by the coal-water slurry should not, as much as possible, contend with coking for raw materials.

4. Producing Activated Charcoal and Carbon Materials

Along with the requirements for environmental protection becoming stricter day by day, activated charcoal in the purification of water and air and in light industry, medicines, chemical engineering, foodstuffs, and other industrial applications is becoming broader day be day. The requirements for carbon products in steelworks, electrification, machine manufacturing, and other departments are increasing at a fast pace and is based on selecting China's low-ash coal as a raw material. Not only are the resources abundant and the supply guaranteed, but the prices are cheap and the quality good. For example, Ningxia's Rujigou anthracite coal can use a two-step washing table and can get fine coal with an ash content lower than 2.1 percent. Then,

after burning, crushing, grinding, material in-mixing, mixing, shaping, soaking, graphitization, and other whole series of processing, graphite electrodes are produced. After industrial testing, the results are good.

5. Blast Furnace Fuel

Blast furnaces spraying powdered coal is an effective technological measure for reducing the coke proportion and the coal and coke replacement ratio can reach 1:0.9, that is, 1 ton of coal powder can substitute for an equivalent of 2.4 to 2.7 tons of raw coking coal. Production practice bears out that it is an important way to save coking coal and to reduce energy consumption in iron smelting. However, presently, the varieties of coal powder which are sprayed are few and the variation of the ash-content is large. If the superior-quality coal sources of Rujigou, Jing-Xi, Xinmi, Datong, and other mining districts were selected, the results would be even more remarkable.

6. Making Carbon Black Directly From Coal

After 20 years of research and being offered for sale commercially abroad in 1981, low-ash anthracite coal was processed as a rubber filler. It has a uniform quality, a low specific gravity, and, when filling, it disperses quickly. The time for mixing and smelting is short and enables the sizing material to be vested with good electrical conductivity and an ability to resist corrosion by chemical reagents. Using coal-made carbon black is equivalent to thermal cracked carbon black or half-strengthened carbon black.

7. Exploiting Clean Pure Carbon-Base Fuels

By passing very low-ash coal through inorganic acids and other chemical treatments, the ash content in the coal will be lowered to 0.2 percent and a clean pure carbon-base fuel will be obtained. Not only can it substitute for liquid and gaseous fuels to drive gas turbines and diesel engines, it is a raw material for the preparation of high-grade graphite, activated charcoal, and other carbon products. This technology also carries out a utility for a comprehensive recovery of the inorganic components in the coal and is what should be brought to people's attention. Aside from this, low-ash anthracite coal can also be used to produce the primary parts of electroacoustic transducers -- carbon grains. By using low-ash semicoke with low $Al_2O_3$ and high $SiO_2$ amounts to smelt 75 percent ferrosilicates, lowered aluminum and energy savings results will be obtained. By fully exploiting the special strong points of low-ash coal, even more new products can certainly be turned out by processing.

IV. Suggestions for Expanding the Production and Rational Use of Low-Ash Coal

1. Increase production of the low-ash potential in the highly volatile bituminous coal and the highly metamorphic anthracite coal. In line with the construction of new coal bases in North China and in the Northwest, the output of China's low-ash bituminous coal and anthracite coal is to continually increase. On the one hand enchanced studies need to be done, including basic quality, utilization technology, and the most superior utilization plans. On

the other hand, reasonable utilization sequences ought to be formulated and several utilization channels readjusted. For example, although Zaozhuang's Guanqiao coal is a highly volatile steam coal, the rate of its sticky body movement is high and is a superior-quality coal for refining metallurgical coke in large blast furnaces. For example, the ash content of Yanzhou's Xinglingzhuang gas coal and fine coal is less than 7 percent, and, in the normal blended coal and blended coal-type coking plans for the first phase of engineering at the Baoshan Iron and Steel Complex, 10 and 25 percent of it, respectively, is blended in. The coking quality satisfies the smelting requirements. This alleviates the limitations on the ash content of other coals and exploits the strong points of low-ash coal.

2. Ensure that low-ash, strongly congealed coals are used in coking. In recent years, the annual coke output in China was 37 million tons and 55 million tons of washed fine coal were used. This amounted to about 100 million tons of raw coking coal. In 1984, China's coal output was 780 million tons, of which the output of coking coal was 370 million tons, satisfying the strongly-congealed coal needs for the development of the coking industry. Provided proper policies and vigorous measures are adopted, domestic resources can achieve self-sufficiency and it will not be necessary to depend on imports. China's strongly congealed coal ought to be strictly controlled in its diversion to other purposes, be listed as a special use material resource, and have its production and utilization controlled.

3. Quickly construct coal washing plants, increase investment, and adopt new coal washing techniques and new technologies. Coal output must be increased. Not only does this depend on the quality of the raw coal and the quantity of supply, it also depends on the capacity of the coal washing plant and the coal washing technology. Presently, the number of coal washing plants in China is small and more than half are beyond their designed capacity production. Under this overload condition at the coal washing plants, requiring them to repeatedly lower the fine coal ash content is comparatively difficult. Because of this, coal washing plants need to be built quickly. This is the key to increasing the production of low-ash coal.

4. Formulate a high quality, high price coal pricing policy. If the output of low-ash coal is to be expanded, there must also be a reasonable pricing policy. As for the present coal pricing policy, it doesn't matter what the comparative price of coking fine coal and raw coal is and what the comparative value of a stipulated ash content with the price is, and it does not enable coal mines or consumers to obtain reasonable economic benefits. By not regulating the comparative pricing of the ash content of fine coal with the price, the difficulties given impetus by coal departments increasing coal quality will be many. At the same time, by not regulating the price differences between strongly congealed coal and other coals, it will also be difficult to promote a reasonable utilization of strongly congealed coal. In regard to the different ash content grades of coal, the principle of "the lower the ash content, the greater the price increase" is to be implemented. Because of this, applying economic laws to promote expanding production and effective utilization of China's low-ash coal resources is completely necessary.

5. Protect low-ash coal resources and its reasonable exploitation and utilization. The use of low-ash coal and its economic value is high and it is also an important material for generating foreign exchange. The export price, market and potential are gratifying. However, presently, there still exists serious waste, and policies and measures protecting the low-ash coal resource, its reasonable development, and utilization need to be studied seriously.

13310/13046
CSO: 4013/12

BRIEFS

COAL EXPORTS UP 33 PERCENT--Beijing, 25 Nov (XINHUA)--China's coal exports are up 33 percent over last year, an official of the Ministry of Coal Industry said today. According to statistics available from the China coal import-export corporation, by 20 November, China exported 8.22 million tons of coal, earning 338 million U.S. dollars. "The coal, from 20 mines including Kailuan, Datong, Zaozhuang, and Huaibei, was exported to Japan, the Philippines, Indonesia, France, Belgium, Denmark, Hong Kong, and eight other countries and regions," he said. The official added, "China is a big coal-producing country, and the amount of coal exported is minor compared with the country's total coal output value." "Five coal mines--Datong, Yangquan, Kailuan, Ruqigou and Pingshuo, have been designated as China's coal exporting centers," he said. The official said his ministry will make efforts to improve coal transportation facilities, upgrade coal quality and increase total coal exports to 30 million tons by 1990. [Text] [Beijing XINHUA in English 2633 GMT 25 Nov 86 OW] /12624

1986 OUTPUT: 870 MILLION TONS--Beijing, 25 Nov (XINHUA)--China's coal output is expected to reach more than 870 million tons this year, according to the Ministry of Coal Industry today. From January to October, China produced 690 million tons of coal, a spokesman for the ministry said. He said that the local small and medium-sized coal mines are expected to turn out more than half of this year's total yield. The major coal mines are expected to produce 7 million tons more of coal this year than last, he added. [Text] [Beijing XINHUA in English 1507 GMT 25 Nov 86 OW] /12624

NEW MINES EXPECTED TO EASE STRAIN--Beijing, 27 Nov (XINHUA)--China will have 23 new coal mines in operation by the end of the year and these new ones will have a combined production capacity of 17 million tons, a coal ministry spokesman said today. The spokesman told XINHUA that "the 23 projects consist of both construction and expansion of coal mines, and most of these mines are scattered throughout eastern China where energy consumption is in greater demand." He said: "these projects of construction or expansion will help ease the energy strains in the industrially-developed eastern areas and provide the necessary energy supply for further development." He said ten new mines with an aggregate capacity of more than 5.9 million tons had gone into production by the end of October, and presently under construction are 108 coal mines with a total designed production capacity of over 129 million tons. [Text] [Beijing XINHUA in English 1213 GMT 27 Nov 86 OW] /12624

NEW HEILONGJIANG RESERVES--Following the discovery of a large coal field in Daxinganling, Heilongjiang Province, the Changchun Scientific Research Institute under the coal field geological bureau of the Northeast China and Nei Monggol Coal Industrial Joint Company has recently discovered another new coal field along the Heli He in Tangyuan County, Heilongjiang Province. According to initial estimates, this coal field has reserves of 7.5 billion tons, and 18 recoverable coal seams, with total thickness of 54 meters. The coal quality is high-class brown coal. [Summary] [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 1 Nov 86 SK] /9738

NEW SHANDONG COLLIERY--On 1 November, the Zouxian Henghe Colliery, another large-scale local colliery in Shandong Province, went into operation. Located in Zouxian and Yanzhou, the Henghe Colliery is part of the Yanzhou Coalfield. The geological reserves of this colliery are 75 million tons, and the quality of the coal is good. The annual design mining capacity is 450,000 tons. [Text] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 1 Nov 86 SK] /9738

BIG JIANGXI FIND--A large coal field estimated to have reserves in excess of 100 million tons has been discovered in Jiangxi Province. The 195th Geological Brigade of the Jiangxi Coal Field Exploration Company, after years of searching, has recently found a large coal field with reserves exceeding 100 million tons in the Qujiang area of Fengcheng. The field covers an area of 50 square kilometers and the coal is chiefly of the lean variety, the coking coal variety, and the fat coal variety. Geological structure is simple and the seams stable. [Excerpts] [Nanchang JIANGXI RIBAO in Chinese 18 Oct 86 p 1] /8309

FUEL OIL REPLACEMENT PROGRAM--Beijing, 21 Nov (XINHUA)--China has used coal to replace 70 million barrels of fuel oil since the government program began in 1981, an official of the state council, China's highest governing body, said here today. Under the coal-replace-oil program, the country's consumption of fuel oil is expected to drop from 280 million barrels in 1980 to 140 million in 1990, the official said, adding that the program will continue through to the end of the century. The program calls primarily for new coal-fueled power generating units to replace oil-fueled ones, renovating other oil-fueled equipment and faster development of coal resources. The official said that money saved from the use of fuel oil will be used for energy and transport development--a priority in the nation's economic growth. [Text] [Beijing XINHUA in English 1525 GMT 21 Nov 86 OW] /7358

CSO: 4010/19

OIL AND GAS

FIGURES SHOW OIL, GAS OUTPUT UP IN 1986

OW121406 Beijing XINHUA in English 1217 GMT 12 Dec 86

[Text] Beijing, 12 Dec (XINHUA)--China had produced 861 million bbl of crude oil and 11 billion cubic meters of gas by the end of November, increases of 4 percent and 3.3 percent respectively over the same period of last year, according to the Oil Industry Ministry here today.

Today annual output of oil and that of gas are expected to reach 949 million bbl and 13 billion cubic meters as against 911 million bbl and 12.83 billion cubic meters last year.

China's largest oil producer, the Daqing oil field, is expected to have pumped out more than 401 million bbl of crude by the end of the year. It will be the eleventh successive year for the oil field to produce annually over 365 million bbl of crude.

Output of the Shengli oil field, China's second-largest, has also gone up. It is estimated that the oil field's increase in crude oil this year will account for more than 40 percent of the national increase.

Oil output of the Liaohe oil field in northeast China is expected to surpass 73 million bbl before the end of this year, making it the third-largest oil producer in the country.

A number of important discoveries have been made this year in oil and gas exploration in both the eastern and western parts of China.

Following the discovery of the Yinggehai gas field in the South China Sea 2 years ago, major gas discoveries have also been reported this year in Sichuan, Shaanxi, Jilin, and Heilongjiang provinces and the Ningxia Hui Autonomous Region.

In offshore oil exploration, a new oil field--the Wei-103 in the Beibu Gulf of the South China Sea--has gone into production.

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CSO: 4010/20

## EXPLORATION, PRODUCTION REGISTERS STEADY PROGRESS

OW310410 Beijing XINHUA in English 0222 GMT 31 Dec 86

[Text] Jinan, 31 December (XINHUA)--While the world oil industry is dwindling owing to oil price cut, China has made steady progress in oil exploration and production in order to meet the urgent needs of its modernization drive.

Chinese Oil Minister Wang Tao told XINHUA that by 20 December China had produced 884,940,000 bbl of crude oil and 12.95 billion cubic meters of natural gas, and by the end of the year, the annual oil output may well reach 910 million bbl and natural gas, 13.32 billion cubic meters, increasing by 4.6 percent and 3.8 percent respectively over last year.

The Daqing oil field, China's largest, located in northwest China's Heilongjiang Province, is expected to produce 389.2 million bbl of oil, 2 million barrels more than last year and the second largest oil field in Shandong will produce 206.5 million bbl.

The Liaohe oil field in northeast China's Liaoning Province may break the 70 million bbl mark to become the third largest in China and the Huabei oil field in north China has maintained its annual output at 70 million bbl.

Wang Tao, 55, inspected a number of major oil fields soon after he took office in June last year and urged all oil fields to explore new areas and this has yielded marked results which will enable China to keep its present oil output, with some increases.

The oil minister said that during the year China signed five new contracts for joint exploration and production of offshore oil resources and imported 20 sets of electronic computers that have helped double the seismic data processing capacity. In addition, the ministry signed 14 technical consulting and feasibility study contracts with foreign firms and five co-production and joint venture projects.

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CSO: 4010/23

## NEW MANAGEMENT BRINGS ORDER TO PETROCHEMICAL INDUSTRY

OW240927 Beijing Xinhua Domestic Service in Chinese 0657 GMT 19 Nov 86

[Article by reporter Huang Fengchu]

[Excerpts] Beijing, 19 Nov (XINHUA)--Because of the large fluctuations in the international price of oil in recent years, the world petrochemical industry has not been thriving, and the growth rate of this industry has even declined drastically in some developed countries. In sharp constrast, however, China's petrochemical industry has been flourishing.

Prior to 1983, the 39 major oil refineries, petrochemical plants, and synthetic fiber plants in China were operated separately by various central departments and local authorities. This state of affairs was not conducive to the rational and multi-purpose utilization of our oil resources and the tapping of our enterprises' potential to the fullest extent. Rather, it caused redundant construction work and a big waste of our oil resources and construction funds. To change this diversified and pluralistic management system and centralize the leadership of the oil-refining, petrochemical, and synthetic fiber enterprises, as well as to conduct overall planning for their work and put them under unified management, the China National Petrochemical Corporation was established in July 1983. The past 3 years or so have shown that this new management system conforms to the characteristics of the petrochemical industry, and its advantages have become increasingly obvious.

-- It has made possible overall planning for explcitation of our oil and gas resources and their rational utilization. In the past, the job of the refineries was limited to oil refining. Their efforts at multi-purpose utilization of the large amounts of useful chemicals contained in the crude oil were often insufficient. Synthetic fiber plants and chemical enterprises were only concerned about manufacturing their own products and ignored the multi-purpose utilization of raw materials. This not only caused waste, but put some enterprises in a situation of chronic shortages of raw materials and often caused them to suspend operations because they lacked raw materials. Now the above-mentioned national corporation can make overall arrangements for the procurement of raw materials and use resources to the fullest extent. In general, the

enterprises under this corporation are working up to about 90 percent of their full capacity, and there is a big rise in their output of industrial chemicals, chemical fertilizers, and synthetic fiber products. Over the past 4 years, the amount of crude oil processed has shown an average rise of 3.4 percent annually. The production of urea in 1986 is expected to outstrip the 1982 record by 1 million metric tons. This is equivalent to the annual production of two petrochemical plants of the same size as the Urumqi Petrochemical Plant, which produces 520,000 metric tons of urea annually. The foreign exchange thus saved for the state will be $110 million. The 1986 output of polyester fiber is expected to reach 185,200 metric tons, a more than twofold rise compared with 1982. This means that on the average, an additional 1.3 meters of synthetic fabric will be produced for each person. Such results would be hard to achieve with the pluralistic leadership and diversified management of the past.

-- It has created favorable conditions for more intensive processing of crude oil, reduced the consumption of heavy oil used as fuel in the refining process, and increased the production of light oil products. By virtue of the increased capacity for intensive crude-oil processing, an additional 2 million metric tons of light oil products have been produced in the last 3 years. The net increase in the output value of two petrochemical plants of the same size as the Wuhan Petrochemical Plant. This year more aromatic hydrocarbons have been supplied to boost the production of polyester. This effort alone has resulted in an extra 600 million yuan in taxes and profits. This is three times the tax and profit scored by the Lanzhou Chemical Industry Corporation in 1985.

It has provided the state with a greater amount of steady financial revenue. In 1982, prior to the establishment of the China National Petrochemical Corporation, the total amount of tax and profit of petrochemical enterprises was 9.5 billion yuan, of which 8.5 billion yuan were turned over to the central financial department. For the period from 1983 through 1986, despite the increased prices of some means of production, the accumulated tax and profit amount is still expected to reach 50.7 billion yuan, of which approximately 41.8 billion yuan will be turned over to the central financial department. This means an average 12.6 billion yuan of tax and profit and 10.4 billion yuan of contribution to the state per year, which surpass the 1982 records by 32.6 and 22.4 percent respectively.

Meanwhile, the China National Petrochemical Corporation, as an economic entity, has put its strength into and focused its efforts on speeding up the building of key state construction projects and technologically upgrading their subordinate enterprises, thus increasing the productive capacity of the petrochemical industry. The key and backbone state projects are four 300,000-metric-ton ethylene projects, three 200,000-metric-ton synthetic fiber project. Some of these projects have been completed and put into operation. Others are under construction, and the construction work is progressing at an accelerated pace.

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CSO: 4013/22

## SHENGLI OVERFULFILLS DRILLING, OUTPUT PLANS

SK260726 Jinan Shandong Provincial Service in Mandarin 2300 GMT 25 Nov 86

[Excerpts] In order to build the Shengli oil field into China's second Daqing at an early date, the 160,000 oil workers working along the banks of the Huang He and the coast of the Bohai Sea have gone all out in construction.

As of the end of October, the oil field had completed 3.77 million meters of drilling footage, fulfilling its annual drilling plan by 89.9 percent. Its daily output of crude oil was over 90,000 tons, a 20,000-ton increase over the figure scored at the beginning of 1986. Major economic and technological targets fulfilled by it topped the standards set during the period since the oil field began its development programs.

Since the beginning of 1986, by upholding the principle of being a vanguard in prospecting work, the Shengli oil field has stressed improving its old wells and prospecting for or drilling new wells. In order to build itself into China's second Daqing, the staff and workers have worked day and night. At the development battle in the Gudong area, the oil field drilled more than 800 wells within 6 months, and daily output of crude oil has reached more than 15,000 tons. It has scored unprecedented speed, standards, and benefits in the oil development history of China. In the Bamianhe area, six prospecting teams, in line with their detailed prospecting data, have successfully fulfilled their 30-day tasks with high standards and quality only within 20 days.

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CSO: 4013/25

## SICHUAN NATURAL GAS DEVELOPMENT MOVING RAPIDLY

Chengdu SICHUAN RIBAO in Chinese 27 Sep 86 p 1

[Article by Li Daiyou [2621 0108 0645] and Shi Feng [4258 1496]: "Exploitation of Sichuan's Natural Gas Gratifying; 45 New Combination Gas Wells Acquired, Natural Gas Production Has Obtained Its Best Levels for Period Since the Sixth Five-Year Plan"]

[Text] The exploration and exploitation of natural gas in Sichuan this year has been gratifying. From January to August, 45 combination gas wells having industrial value have been newly acquired. Of these, 34 of these new wells have successively gone into operation and supplied gas. The natural gas production has increased 7 percent over that for the same period last year, achieving the best levels compared to the same period during Sixth Five-Year Plan.

In light of the contradiction between the increased tasks for this year's natural gas production and the rather large gap in funds, the Sichuan Petroleum Administration Bureau has made some adjustments and reductions in the scale of construction and investment and has concentrated financial and material resources to maintain the exploration and exploitation of natural gas in key projects. Thus, it has led to rather large increases in natural gas reserves and production. From January to August of this year, the Bureau started drilling 86 wells and has completed drilling 72 wells. Forty-five wells of combination gas were newly acquired, of which 43 were gas wells. A group of gas pools and gas-bearing structure and fissure systems was also acquired. Moreover, during exploration there were new discoveries of gas pools in areas in eastern Sichuan and transition belts from southern Sichuan to the middle of Sichuan as well as new areas and new structures. Thus, the territory for natural gas exploration and exploitation was enlarged.

In order to increase even more the production of natural gas for the country, the Sichuan Petroleum Administration Bureau is vigorously implementing a policy of "less investment, greater production" and "making use of available resources." In one way, the Bureau is quickening the rate of exploration of waterless gas fields, and it is adopting techniques and measures such as fracturing and acidation, water drainage and gas extraction, and rebuilding wells and increasing pressures. In only the first half of the year, natural gas production increased more than 300 million cubic meters. In another way, the Bureau is adhering to science and explointing the gas fields rationally and is carrying out management by category and level divisions. This has enabled production to resume to some

extent at a group of old gas fields such as Weiyuan and others, and steady increases have been obtained. At the same time, it vigorously stressed surface construction at the gas fields and actively organized the production of new wells; from January to August there were 34 new gas wells successively going into production and supplying gas. From January to June, the Bureau supplied 379 million cubic meters of surplus gas and surpassed the plan by 16.7 percent, and 230 million cubic meters of gas were oversupplied to Sichuan Petrochemical, Lutian Petrochemical, Sichuan Fiber and other key consumers alone. However, due to numerous accidents which have occurred at some of the key consumers and at desulfurization plants,and because the Shawo gas trunk line has not been able to go on line in time, the production of natural gas has been affected by 83.93 million cubic meters.

13310/12951
CSO: 4013/16

## MESSAGE TO FOREIGN FIRMS: 'SHARE THE RISK'

OW091805 Beijing XINHUA in English 1610 GMT 9 Dec 86

[Text] Guangzhou, 9 Dec (XINHUA)--China wants to share the risk in developing its continental petroleum resources exploration industry with foreign firms, said a high-ranking official of the oil industry.

Addressing China's first symposium on continental oil engineering that opened here today, deputy general manager of the China National Oil Development Corporation, Cheng Shouli, said China wants foreign firms to get involved in "risky exploration, joint development and dividing products according to investment ratio."

Joint operations should also take place during the early and risky geophysical exploration, joint feasibility studies of exploration over a basin or raising the oil recovery rate by using crude oil to compensate for the investment of foreign firms.

The Chinese Government last year decided to designate a 1.83-million-square-kilometer area in south China as an oil exploration region in cooperation with foreign companies. The area covers the Guangxi Zhuang Autonomous Region and nine provinces, including Anhui, Zhejiang, Jiangxi, Jiangsu, and Quangdong.

Chinese and foreign oil experts believe that the area is very likely to contain rich oil resources.

Deputy General Manager Cheng said that 60 companies from 16 countries have contacted the China National Oil Development Corporation.

Sponsored by the Chinese corporation and a Hong Kong firm, the 5-day symposium is being attended by 60 firms from Australia, Britain, Canada, France, Federal Germany, the Netherlands, Singapore, the United States, and China.

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CSO: 4010/21

## FOREIGN CONSORTIUMS STUDY DEVELOPMENT OF SOUTH CHINA SEA FINDS

HK130248 Hong Kong SOUTH CHINA MORNING POST (BUSINESS POST) in English 13 Dec 86 pp 1, 8

[Article by Olivia Sin]

[Text] Two oil consortiums which have made encouraging discoveries in the South China Sea are actively studying the likelihood of developing their finds, according to a senior Chinese oil official.

But plans by the Phillips-Pecten group and the Agip-Chevron-Texaco [ACT] consortium are apparently overshadowed by current depressed oil prices and high production costs inevitable in the deep and rough waters in this area.

Sources said both groups were likely to ask China to ease the terms of their original contracts to improve the commercial prospects for their production plans.

The vice-president of the China National Offshore Oil Corp. (CNOOC), Chen Bingqian, told the SOUTH CHINA MORNING POST in an interview in Beijing that Phillips and ACT were likely to develop their oil fields.

"They have placed the development programs on their agenda. Both consortiums are conducting conceptual design (of the production facilities)," he said.

"Experts have made several rounds of studies into their discoveries...the oil fields are likely to be developed."

Mr Chen said the two fields are medium-sized with annual output of about 1 million tons projected.

Both contract areas are near Hong Kong and spinoffs from their development would benefit industries in the territory, particularly ship-repair and oil-related supplies companies.

Phillips and ACT were granted the contract areas in the Pearl River estuary 3 years ago under the first round of offshore bidding.

Two other consortiums engaged in exploration in the first round, Esso China and Occidental Eastern, have also made discoveries in the South China Sea but have so far not taken any action beyond feasibility studies.

Industry sources said the Phillips and ACT finds were by far most encouraging.

Phillips, however declined to comment on any ambitions it might have to develop the field.

Sources close to ACT confirmed that the consortium was conducting feasibility studies and looking into the design of production rigs.

While declining to disclose the extent of reserves, the sources said the discovery was considered a "marginal field" particularly in the context of the present low level of world oil prices.

They said ACT would ask China to revise the original tough contract terms to make the production plan viable.

Analysts said ACT was likely to ask China to waive the 12.5 percent royalties to be levied on oil produced under the original contract.

Oil companies awarded contracts in the second round were exempted from royalty payments in marginal fields producing less than one million tonnes of oil a year.

ACT was also likely to seek a change in the division of profits envisaged in the original contract so that a bigger proportion of the oil produced could be used to recover exploration and production costs.

"One needs a lot of faith to continue working in China in view of the risk and costs," said one source close to ACT.

Industry sources said it would be difficult for Phillips would be difficult for Phillips and ACT to go ahead with production if oil prices fell below U.S. $15 a barrel.

Production costs would be high, they pointed out, because the rigs must be strong enough to withstand the frequent typhoons in the South China Sea, which was even more demanding than the North Sea.

ACT is understood to be waiting for the results of its third appraisal well before deciding whether to go ahead with its production plan.

The well was spudded at the end of last month and the appraisal is expected to be completed by mid-January.

If all goes smoothly, ACT will finish all its technical and economic evaluation studies by March and begin discussing production proposals in detail with CNOOC.

At present, ACT does not appear too enthusiastic about production prospects and has taken meticulous care in making its evaluation studies.

So far, six wells, including four wildcat and two appraisal wells, have been sunk by ACT and a seventh is currently being drilled.

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CSO: 4010/20

## BRIEFS

NEW SHANDONG POOL--At the newly discovered (Caoqiao) oil pool of the Shengli oil field, Shandong Province, 25 oil wells were recently drilled, with a daily production capacity of more than 500 tons. This oil pool is located at the juncture of Guangrao and Boxing counties. The verified oil-bearing area covers more than 10 square km, and the thickness of underground oil-bearing formation is about 20 meters. [Summary] [Jinan Shadong Provincial Service in Mandarin 2300 GMT 7 Nov 86 SK] /9738

SHENGLI DIRECTIONAL DRILLING--Shandong Province's Shengli oil field has discovered a high-yield oil well with a daily production capacity of 201 tons under the major river course of the Huang He by adopting directional drilling technology. [Text] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 19 Nov 86 SK] /9738

CSO: 4013/25

## ZHOU PING: NUCLEAR POWER CAN SOLVE ENERGY SHORTAGE IN SOUTHEAST

Beijing RENMIN RIBAO in Chinese 4 Sep 86 p 5

[Article by Senior Engineer Zhou Ping [0719 1627], Vice Minister of the Ministry of Nuclear Industry: "Development of Nuclear Power Is Solution to Southeast China's Energy Shortage"]

[Text] The energy resource problem is the primary issue that must be dealt with if China is to achieve its four modernizations drive, and it affects to a very great extent our progress toward the four modernizations. Although China has rich energy resource reserves, they are very unevenly distributed. There are regional differences in the degree of abundance of energy resources and regions may have either excellent or terrible development conditions. Nearly 80 percent of China's proven coal reserves are found in the north, 64 percent of them in northern China, while only 2 percent are found in the eight provinces south of the Chang Jiang. Some 70 percent of our hydropower resources are located in the southwest. The total amount of energy resources found in the three large eastern, northeastern, and south-central regions of China account for only about 15 percent of total energy resource reserves in China. The energy resource reserves in 13 provinces, including the eight provinces south of the Chang Jiang as well as Shandong, Hebei, Liaoning, Jilin, and Henan, account for only 13 percent of total national reserves while they contain 63 percent of the nation's population and account for 65 percent of the energy consumption. This has led to an irrational distribution in which the national economy is centered in the east and energy resources are concentrated in the west.

To deal with this uneven distribution of energy resources, we often are forced to rely on the north to ship coal to the south and on the west to send electricity to the east to supplement. The shipment of energy resources accounts for more than one-half of total shipping in China and coal shipments account for more than one-third of shipping by water, which has created extreme communications and transportation shortages.

Despite the great deal of effort that has been expended, a serious energy shortage persists in some provinces in southeastern China. As an example, the three provinces and one municipality located in eastern China region are a heavy industry base area that accounts for one-fourth of the value of industrial output in China, and it also is an important grain, cotton, and

farm and sideline product base area. East China has a serious energy shortage, however, and more than 70 percent of the coal used to generate electricity must be shipped from over 20 mines located in other regions. The region has a one-third shortage of electrical power. If the present energy structure in China is not transformed quickly, it will be impossible to change the serious energy shortage in this region.

Because nuclear fuels produce so much from so little, the development of nuclear power plants in southeastern China is in full conformity with the situation in that region. It not only is capable of satisfying the energy resource demands of these areas but also can alleviate communications and transportation shortages. Some have estimated that the construction of a 10-million kW nuclear power station in eastern China could conserve 36 million tons of raw coal each year and reduce the amount of freight handled by 13.6 billion ton/kilometers each year. The development of nuclear power could play an extremely obvious role in overcoming the electric power shortage and extreme pressures on communications and transportation in the east, northeast, and south China regions.

It is apparent that if we achieve appropriate development of nuclear power along with coal-fired and hydropower, China's energy resource structures gradually will assume a tendency toward rationalization.

A solution to China's energy resource problems requires active development of new energy resources and energy resource diversification. Premier Zhao Ziyang has pointed out that "we should accelerate development of the electric power industry in the three areas of hydropower, thermal power, and nuclear power." This is entirely correct.

China does not have only an energy resource shortage. We also have raw materials shortages in the chemical industry. The development of nuclear power could conserve large amounts of coal and crude oil to permit intensive processing of coal and crude oil. This is of great significance for promoting the development of the people's daily needs and rational energy resource utilization.

What are the conditions for the construction of nuclear power plants in China?

1. China has definite reserves of nuclear materials and a rather strong nuclear industry base. Geological prospecting for uranium ore over the past 30 years has proven reserves of metallic uranium. Besides meeting military needs, it could supply pressurized water reactor nuclear power stations on a substantial scale for 30 years of continuous operation. Improvements in prospecting technologies in the future will enable us to find even more uranium ore. In the area of the nuclear fuel industry, we have established a complete nuclear fuel cycling system for mines, smelting, nuclear fuel conversion, uranium isotope concentration, reactor pile component manufacture, post-processing and other areas that include a uranium ore smelting capacity and uranium isotope concentration capacity that is tenth in the world. The nuclear submarine reactor fuel components that China designed and developed on its own have not been damaged during operation.

2. China has rather mature experience in design, manufacture, and operation of reactor piles.

We relied on our own resources to develop producing reactors, submarine reactors, and research and experimental reactors. Through practice, we have accumulated more than 120 reactor years of operating experience and formed a preliminary complete reactor design and scientific research system, and we have various types of experimental equipment in the areas of physics, thermal hydraulics, chemistry, corrosion, fuel components, materials, safety and processing of waste gas, waste water, and industrial residues. We have carried out more than 10 years of exploration concerning design and experimental research on nuclear power stations, and we ourselves designed the Qinshan nuclear power station.

3. The nuclear equipment and instrument research and design and special materials industries have a solid foundation in China.

During the process of developing the "two bombs and one submarine" (the atomic and hydrogen bombs and the nuclear submarine) that began quite a while ago, machine and electronics industry departments in China undertook a great deal of coordination and developed key nuclear equipment and instruments for the nuclear industry. Metallurgical and chemical industry departments have developed large amounts of special materials. We also have built and developed nuclear power equipment and the various types of materials needed in recent years to outfit the Qinshan nuclear power plant.

4. China has a scientific and technical staff of fairly good quality and a rather full complement of specializations that basically is capable of meeting the needs of nuclear power construction in China.

5. China has a rather complete educational base area for training personnel in nuclear science and technology.

China began setting up atomic energy and engineering physics departments at several well-known universities of science and engineering during the 1950's, and it established specializations in nuclear physics, reactor pile engineering, isotope separation, radiation chemistry industry, nuclear materials, accelerator physics, nuclear electronics, nuclear safeguards, and other areas. Over the past 30-plus years, we gradually established an integrated nuclear science and technology, production and education system that has trained several 10,000 specialized nuclear scientific research and engineering personnel. On this foundation, we are using reform in educational systems to train various types of personnel to develop nuclear power.

To summarize, China urgently needs and also has excellent conditions for development of nuclear power. We first of all should solve the energy shortage problem in southeastern regions and then gradually transform the energy resource structure of China as a whole.

12539/13046
CSO: 4013/159

NUCLEAR POWER

## ISSUES IN CONSTRUCTION OF NUCLEAR POWER PLANTS DISCUSSED

Beijing GUANGMING RIBAO in Chinese 1 Aug 86 p 3

[Article by Minister Jiang Xinxiong [5592 1800 7160] of the Ministry of Nuclear Power: "Issues in China's Nuclear Power Construction"]

[Text] China began nuclear power construction during the Sixth Five-Year Plan and progress has been excellent at the Qinshan nuclear power plant in Zhejiang and the Daya Wan nuclear power station in Guangdong. An accident in the No 4 reactor at the Soviet Union's Chernobyl nuclear power plant on 26 April 1986 leaked large amounts of radioactive material, polluted the environment for a period of time and attracted the attention of all nations in the world. It had a definite impact on construction of nuclear power stations, and it has encouraged us to undertake further consideration of the safety question in China's nuclear power construction.

The designs of China's two nuclear power stations involve pressured water reactors, which are fairly mature in the world at the present time, and they employ safety design standards based on practice and investigation. The nuclear power stations have three sealed screens, a containment shell, pressurized container and safety shell for the nuclear fuel components, to prevent the leakage of radioactive materials if an accident were to occur. These two nuclear power stations also have various types of safety measures to permit immediate regulation in the event of abnormalities through guaranteed supplies of water and electricity. The environmental impact report for the two nuclear power stations has been examined and approved by state environmental protection departments and the corresponding work now is underway in an intensive manner. Experts in the field feel that safety concerns at these two nuclear power stations are firmly in hand.

Nuclear power construction in China must resolutely adhere to the principle of active and appropriate development to guarantee the safety of nuclear power construction, and work arrangements are proceeding according to original plans. After the Three Mile Island accident in the United States in 1979, some nations slowed the progress of nuclear power construction, which also slowed their economic development. In contrast, some countries have persisted on the road of developing their own nuclear power and sustained stable development of nuclear power to meet their energy needs and permit technological and economic development with no safety problems

whatever. Nuclear power in some nations had grown to a considerable degree in some nations and regions up to 1985. France and Spain, for example, achieved 4.6-fold and 3.4-fold increases, respectively.

After the accident at the Soviet nuclear power station, most nations of the world still consider nuclear power to be a clean, safe and economical energy resource and indicate that they wish to continue to develop nuclear power. It was announced at the meeting of leaders from seven developed nations convened in Tokyo on 5 May that safely-managed nuclear power is and will continue to be a widely utilized energy resource. The government of West Germany has stated that the FDR will not abandon its policy of a peaceful use of nuclear power because of the accident at the Soviet nuclear power station. West German experts have pointed out that if West Germany were to close all of its nuclear power stations and shift to burning coal to generate electrical power, the nitrous oxide and sulphur content of the atmosphere would increase by 1 million tons over current figures. This would lead to greater amounts of acid rain that thereby would kill forests and also increase the rate of asthma, children's laryngitis, skin diseases and other maladies. The cost of electricity also would be 30 percent higher than at the present time. The Soviet Union also has indicated that it will adopt supplementary measures in the future to assure even greater reliability of the nuclear power industry and that the nuclear power industry will continue to develop as planned. An overwhelming majority in the European Conference, a joint European legislative body, passed a decision to continue to develop nuclear power in Western Europe on 15 May. Hans (Bulikesi), head secretary of the International Atomic Energy Organization said that although people have expressed concern about the dangers of nuclear power following the accident at the Soviet Union's Chernobyl nuclear power plant, nuclear power will continue to develop.

During the overall process of building nuclear power stations and their future operation to generate power, China has absorbed the experiences and lessons of accidents at nuclear power stations in other countries and has adhered to the concrete principle of safety and quality first throughout the process and we have not relaxed our vigilance because we have adopted more mature and safer pressurized water reactors. Just the opposite, we must be strict in our planning and adopt a serious attitude, effective measures and scientific management to guarantee the safety of nuclear power stations.

1. Strengthen leadership of the entire construction process for nuclear power stations and focus on quality and safety through on-site organization, personnel assignments and training, design, construction and installation, and equipment manufacture and purchase.

2. Strengthen management of nuclear power safety, establish and perfect laws and regulations governing nuclear power safety in China by absorbing and importing current international laws and regulations. More than 60 laws and regulations have been formulated or are in the process of being formulated, including laws and regulations, decisions and guiding principles. The Guangdong nuclear power station has adopted French safety standards in

principle but caution also should lead us in making further investigations concerning the use of safety laws and regulations from Chinese and international atomic energy organs.

3. An overall outline of strict quality guarantees should be formulated during the construction of nuclear power stations and we should establish and perfect a complete system of quality guarantees to assure that every link and work procedure in the overall plan for nuclear power engineering design, construction, installation, adjustment and testing, startup and operation are carried out according to laws and regulations and quality controls to build nuclear power stations of superior quality and safe operation.

4. Strict implementation of a training and testing system for operational and management personnel in nuclear power stations to set up well-trained operational staffs are the keys for assuring that future nuclear power stations generate power safely.

5. The state has established the State Nuclear Safety Bureau to guarantee the safety of nuclear power. It is responsible for supervision and inspection of safety at nuclear power stations throughout China, and it has decided to set up nuclear safety supervision stations near the Qinshan and Guangdong nuclear power stations. The relevant departments will have a division of labor and close coordination of their responsibilities to work jointly for good nuclear safety work.

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## PUBLIC ASSURED CHINESE PLANTS POSE NO HEALTH THREAT

Beijing GUANGMING RIBAO in Chinese 1 Aug 86 p 3

[Article by Geng Xiusheng [5105 4423 3932] and Wang Chaode [3769 2600 1795]: "Nuclear Power Plants and Human Health"]

[Text] Nuclear power is a new energy resource that now occupies a decisive position in world energy resources. Like any other advanced technology, however, nuclear power can enrich mankind but does involve certain risks.

As everyone knows, nuclear power employs the enormous amount of energy released during fission reactions to generate power. A large amount of radioactive material also is produced along with the energy emitted by nuclear fission. If this material is released into the environment, it may lead to radioactive pollution of the atmosphere and water as well as plants and animals and thereby subject people to varying amounts of additional irradiation by ionizing radiation. Very little radioactive material is discharged by nuclear power plants under normal operating conditions, as shown by the present situation at nuclear power stations in different countries. Experience in operating pressurized-water reactors, the type to be used in the nuclear power plants now under construction in China, indicates that the maximum whole body dosage to the public ranges from 0.05 to 5 milliRems/year and averages 0.78 milliRems/year. The maximum figure is equal to the radiation dosage received from cosmic rays during a round trip flight from Los Angeles to London (4 milliRems) and is one-tenth less than the dosage received during a single chest X-ray. It is apparent that the dose received by the population around a nuclear power station is very small. Nuclear power certainly is a comparatively clean utilizable energy resource.

What sort of danger does this small amount of additional irradiation pose for people? Generally speaking, the damaging reactions of ionizing radiation on the human body can be divided into two types. One type is non-random reactions. There is a fairly clear threshold value for this type of reaction and the injuries it can cause include cataracts of the eyes, benign damage to the skin, reduction of the cells in bone marrow and the resultant obstruction of blood formation, infertility due to damage to reproductive cells, injury to blood vessels and connective tissue and so on. The severity of the damage to organs or tissue is determined mainly by the dosage received and harmful recations of the sort mentioned above are not seen below certain dosage levels. The other type of reactions are called random reactions, manifested primarily as cancer or hereditary diseases or defects. The severity is unrelated to the amount

of the dosage but the probability of occurrence is related. There is no threshold dosage, but even a small amount of ionizing radiation can increase the likelihood of cancer and genetic reactions (this is, however, only a hypothesis at the present time; some scholars have different views and feel that threshold dosages do exist). As for small doses of radiation, the thing that concerns us most is random reactions, which involves cancer and genetic problems.

How great, then, is the danger of cancer caused by ionizing radiation? Based on a survey of those irradiated by the Hiroshima and Nagasaki atomic bomb explosions in Japan and survey research on the relationship between the rate of cancer occurrence and dosage in radiation treatments for rigid spondylitis, workers in uranium mines, workers who paint watch faces with radium and others exposed to radiation, the International Commission on Radiation Protection (ICRP) has set the degree of danger from cancer caused by radiation at $10^{-4}$ $Rem^{-1}$, meaning that if a person received a whole body exposure of one Rem, the probability of cancer occurring would be 1 in 10,000. This can be interpreted as meaning that if 10,000 people were exposed to one Rem of whole body radiation, one of them would develop cancer. We can use this to estimate the maximum probability for members of the population around pressurized-water reactor nuclear power stations at 5 x $1^{-7}$ and the average value at less than 1 x$1^{-1}$, which is lower than the 3.6 x $10^{-6}$ death rate from natural phenomena (lightening). Some have analyzed the average annual death rate from cancer in the United States between 1970 and 2000 and determined that 97.4 percent of cancers are due to factors other than radiation. Ionizing radiation in the nuclear power industry causes only 7.5 cases of cancer per 1,000,000, which is less than the natural rate of cancer occurrence, which is 1 in 100,000. When compared with coal-burning power stations, the occurrence of cancer and acute reactions caused by the large amount of carcinogetic material discharged by coal-burning power stations are as much as 100 times greater than nuclear power stations. According to estimates made in the Soviet Union, the cancer rate of residents living near coal-burning power plants is 30 times greater than for nuclear power plants. In addition,, it also should be pointed out that no instances of cancer caused by small doses of ionizing radiation have been discovered, nor is there any firm data from animal experiments.

We can see from the analysis above that the danger to people from nuclear power plants during normal operation is miniscule. People's greatest worries concern accidents at nuclear power stations, and this should be a concern. To date, the world has seen two major accidents at nuclear power plants. No personnel were injured by the 1979 nuclear accident at Three Mile Island in the United States. The maximum whole body dosage of those living within 50 miles of the power station was 70 milliRems. If we estimate the danger of cancer at 10 Rems, the rate of cancer occurrence would be 0.2 people, which means that the number of cases of cancer in the 2 million people living within 50 miles of the power plants would be less than one person. The total number of cases of cancer in the United States during 1979 was 197,603. This shows clearly that the Three Mile Island accident had no significant effects on human health. The accident at the Soviet Union's Chernobyl nuclear powers tation killed several tens of people and polluted the environment

over a wide area, which was of course the worst misfortune in the history of the nuclear power industry. The International Atomic Energy Commission is organizing specialists from many nations to analyze the causes and derive experience and lessons from this accident, adopt even safer measures, strengthen management in all areas and guarantee the health and safety of nuclear power stations and those who live around them. To assure the safety of nuclear power station construction and operation, Chinese government departments have issued four decisions concerning nuclear power plant safety and the State Nuclear Safety Bureau and related organizations are organizing the drafting of regulations on nuclear installations, protection from ionizing radiation and other aspects of safety management. China has chosen to utilize pressurized-water reactors, which are more mature and have good records of safe operation. Serious accidents are entirely avoidable if we work earnestly to strengthen training for nuclear power station personnel and reinforce supervision.

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NUCLEAR POWER

## 5MW REACTOR TO BE USED FOR URBAN HEATING

HK160350 Beijing CHINA DAILY in English 16 Dec 86 p 1

[Article by Da Chansong]

[Text] For the first time, China is to experiment with nuclear power as a clean and economical way of providing central heating for urban dwellers.

A 5-megawatt integrated low-temperature heating reactor, developed by the Nuclear Power Research Institute of Qinghua University, is now being installed about 60 kilometres northwest of Beijing.

Safety is the prerequisite for the reactor, according to Wang Yongqing, a professor at the institute. The institute has adopted a series of safety measures and procedures to ensure against any dangers. Scientists also insist that safety will not be a problem because the low-temperature, low-pressure reactor is different from more powerful nuclear power reactors.

The gains in safety, environmental protection, reduced need for investment and the simpler equipment are also seen as attractive.

After installation is complete in September 1987, the reactor is expected to provide heat for a surrounding area of 70,000 square metres, said Wang. The average Beijing apartment has 50 square metres of space.

The uranium core will generate heat through nuclear fission, which warms the surrounding water. Apart from the main heating system, the reactor also includes 18 supplementary systems for additional heating facilities and to provide safety features, said Wang.

As a key scientific research project, the experiment in low-temperature nuclear heating started in 1982, when coal was in short supply. It is an improved type based on Soviet and West German designs, according to Wang.

Switzerland, Sweden, Finland, Canada, and France are also doing research on various kinds of low-temperature heating reactors. Others have shown great interest in the Chinese market. Many of them hope to invest to build reactors here and then spread the technology to the outside world," said Wang. Some institutes and companies in West Germany and Switzerland have already cooperated with China on the reactor project.

The reactor will do a series of tests to prepare for larger scale operation. Based on experiments already completed, China is also planning to build a 450-megawatt low-temperature nuclear reactor in the city of Harbin, Heilongjiang Province. This reactor is expected to be capable of providing heat for an area of 10 million square metres, which can save 600,000 tons of coal a year.

"It costs much less than burning coal. It is an efficient way to ease energy shortages and relieve the strain of coal transport on the railways," said Wang.

The reactor is not only suitable for residential heating, but can also provide steam for industrial use and generate electricity under low temperatures.

The reactor has a wide range of other uses. Using the neutron emissions from the reactor, irradiation can be provided for sterilizing medical equipment and to irradiate food for storage. Such a reactor could also provide refrigeration for large buildings and desalinate sea water. The 450-megawatt heating reactor could make 110,000 tons of fresh water a day, said Wang.

Beijing has the largest centralized heating system but it meets only 16 percent of the total need. Liaoning, Jilin, Heilongjiang, Shanxi, and Shandong have also rapidly developed their centralized heating systems in recent years, but most places are still using small boilers, causing a waste of fuel and air pollution.

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SUPPLEMENTAL SOURCES

## DEVELOPING GEOTHERMAL RESOURCES OF THE NORTH

Beijing GUANGMING RIBAO in Chinese 15 Aug 86 p 3

[Article by the State Science and Technology Commission Industrial Bureau]

[Excerpt] Records of the use of hot springs in China to treat illness extend as far back as 100 BC. As science and technology have developed, geothermal energy has been used for heating, power generation, aquatic breeding, vegetable growing, and the processing of agricultural and sideline products, and it is playing a role of increasing importance in development of the national economy.

### I. North China Is Rich in Geothermal Resources

Frequent fault-block activity in the North China Plain, which is located in the North China fault block region, has formed a structural arrangement of alternating block-shaped uplifts and subsidences of varying size, orientation, and shape that have created extremely rich geothermal resources in a vast region that extends from Yan Shan in the north to the Taihang Shan range and westward to the peaks of Qinling Shan, south to Dabie Shan, and eastward to a point near the shores of the Bohai Sea and Huang Hai. Medium and low temperature heated water of 120°C can be found in strata at depths of less than 300 meters in these areas that provides shallow heat reserves, high temperatures, and a broad distribution when compared with similar regions in China and foreign countries. The distribution of the temperature gradient is such that it is 5°C/100 meters in the southeastern parts of the city of Beijing and as high as 7°C/100 meters at Jinghai in Tianjin. The figure exceeds 3.5°C/100 meters at Dalian and can reach a maximum figure of 11°C/100 meters at Xiongxian County in Hebei. There are more than 100 sites with such thermal abnormalities in the North China Plain that cover a total area of several 100,000 square kilometers. Preliminary estimates are that recoverable geothermal water resources within 3,000 meters [of the surface] in north China are equivalent to 47 billion tons of standard coal. These include geothermal resources equivalent to 10.2 billion tons of standard coal in some parts of Beijing, Tianjin, Tangshan, Langfang, and Cangzhou.

A large number of hot water wells have been drilled during exploration in the North China Plain by the petroleum system over the past 20-plus years. Almost 500 of the more than 1,500 wells drilled in central Hebei Province have erupted

with hot water. Scientific and technical personnel have taken measurements at over 180 of these wells and discovered water ranging in temperature from 55° to 95°C and averaging about 70°C. The capping strata range from 700 to 1,500 meters thick and the shallowest wells are only 500 meters deep. The amount of water they produce ranges from 500 to 1,000 tons per day and may reach 9,000 tons at some. Well mouth pressures are relatively high, generally 0.5 to 3 atmospheres. It is apparent that northern China is both rich in geothermal resources and has favorable developmental conditions.

## II. Preliminary Results in Geothermal Development in North China

On the basis of work in all departments and regions, the Research Office for Joint Geothermal Resource Development and Planning in North China focused first of all on the basic topics and demonstration work needed for plan formulation. This first group of research topics basically have been completed and preliminary results have been obtained using geothermal energy to develop vegetable raising and aquatic breeding and preliminary ideas concerning geothermal development plans for the North China region have been completed.

Beijing now has an area of more than 250,000 square meters that is heated using geothermal energy. The Beijing Air Force Hostel, for example, uses 64°C underground water to heat buildings covering nearly 40,000 square meters. In addition, it uses the geothermal tail waters for a bathhouse. This saves 1,200 tons of coal each heating season and it has reduced environmental pollution. Hebei Province's Cangzhou Prefecture has used geothermal energy successfully to deal with the overwintering problems of parent fish, parent shrimp, and river crabs. They are using four geothermal wells to build 36 overwintering sheds for parent fish and parent shrimp that contain over 20,000 parent fish and 4 million fingerlings. They have utilized geothermal energy to develop edible fungi breeding and sell 1 million jin of edible fungi on international markets. The four Hebei Province counties of Xiongxian, Gaoyang, Gu'an, and Hejian used six geothermal wells to build more than 220 greenhouses and over 120 sheds for geothermal vegetable raising covering an area of more than 2 million mu. They produced nearly 2 million jin of cucumbers, tomatoes, edible fungi, and other types of fresh vegetables between the winter of 1985 and the spring of 1986. People in the area are using the geothermal water to grow strawberries and for poultry hatching and tanning trials, with rather good results.

## III. The Prospects for Development of Geothermal Energy in North China

Initial conclusions from demonstrations and tests of geothermal energy utilization indicate that each geothermal well can heat 300,000 to 350,000 mu of vegetable greenhouses each winter and 100 to 150 mu of large vegetable sheds during the spring and fall. Each year, one well can produce 1 to 1.5 million jin of vegetables and 1.2 to 1.5 million jin of edible fungi; it can raise 1.2 to 1.5 million fish fingerlings; it can tan 200,000 to 300,000 hides; it can provide arrangements for 2,000 to 3,000 convalescing personnel; it can provide employment opportunities for 100 to 200 people; and it can conserve 2,500 to 3,000 tons of coal, with net profits of 300,000 to 500,000

yuan. Total investments for production and living facilities for a single geothermal well range from 800,000 to 1 million yuan and can be recovered completely in only 2 or 3 years. Each well can be used for 30 to 50 years.

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## DAYLIGHT SAVINGS TIME EXPERIMENT SAVES ENERGY

OW291257 Beijing XINHUA In English 1029 GMT 29 Nov 86

[Text] Beijing, 29 Nov (XINHUA) -- China's first experiment with daylight savings has paid off with huge savings in electricity. So the country's clocks will spring forward again mid-April next year.

More than 627 million kilowatt-hours of electricity were saved when the nation's clocks were turned ahead 1 hour during the summer.

This information was collected through a sample survey by the Ministry of Water Resources and Electric Power.

Statistics show that most of the electricity saved would have been used by urban residents for lighting. The measure also saved lives as traffic safety improved along with visibility because the sun rose an hour earlier.

The city of Shanghai, one of the most densely populated and crowded cities in China, was credited with saving an average of 164,000 kWh per day, or as much as 21.8 million kWh between May and September.

In Xi'an traffic accidents were reduced by 6.2 percent and the number of traffic deaths dropped by 66 percent.

The State Council attributed the successful experiment to careful arrangements by all departments.

The council also pointed out that not all areas in the country benefitted. In southwest and northwest China there are not as many daylight hours so residents there noticed little advantage in changing their clocks.

The State Council said the daylight saving will begin again next April.

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